BROCHURE

Fruits & Fruit Products Exhibition

CALCUTTA

Chief Patron

His Excellency Sir John Arthur Herbert G.C.I.E.

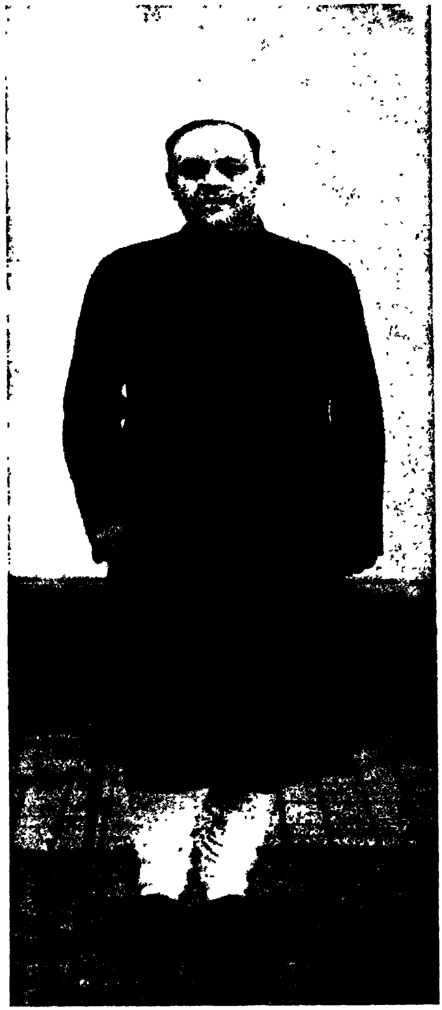
Governor of Bengal.

Held at the

TOWN HALL, CALCUTTA

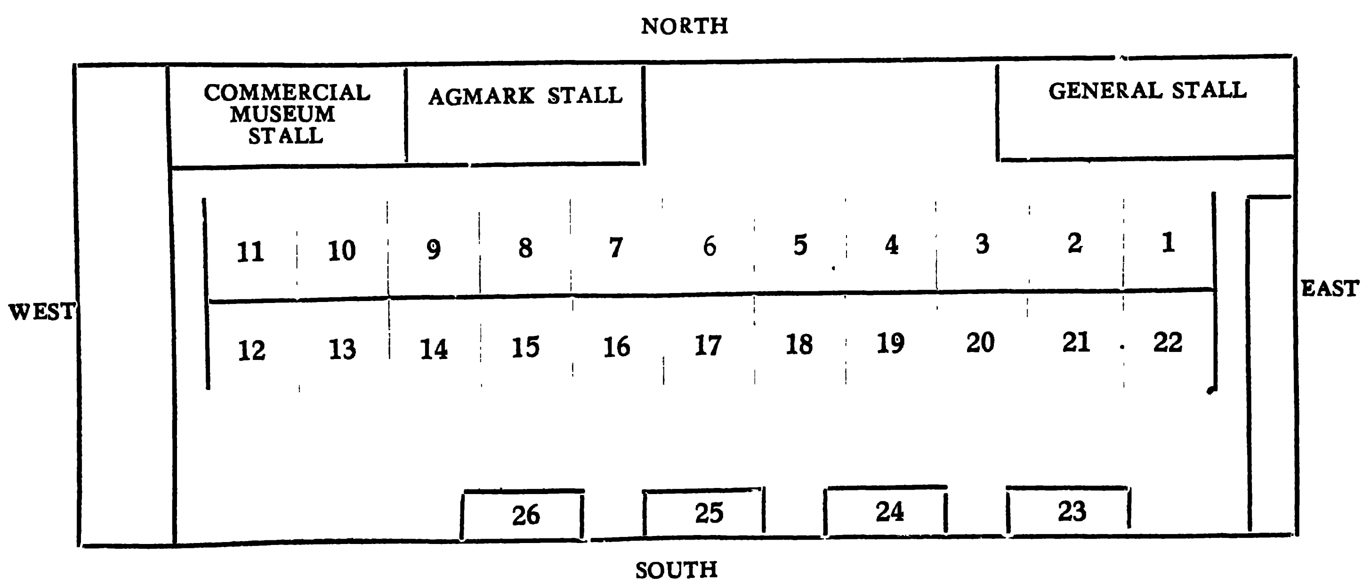
2nd to 11th January, 1942





The Hon'ble Nawab Khwaja Habibullah Bahadur of Dacca.
Minister for Agriculture & Industries.
President. Exhibition Committee.

PLAN OF THE EXHIBITION.



STALL HOLDERS.

A. General Stall.
B. Agmark Stall.
C. Commercial Museum Stall.
1. Metal Box Company, Calcutta,
2. Pal's Fruit Products, Amritsar &
   Northern India Food Products, Lyallpur, Punjab.
3. Sreekissen Dutt & Co., Calcutta.
4. S. A. Rahman & Sons,, Lahore.
5. Bengal Canning & Condiment Works Ltd., Calcutta.
6. Murshidabad Dairy and Condiments, Calcutta,
7. Daw Sen & Co., Calcutta.
8. Jaina Silpa Mandir, Calcutta.
9. Farm & Fruit Products, Calcutta.
10. Ideal Fruit Preserving Works, Calcutta.
11. Nirula and Company Limited, New Delhi.
12. Farmers Preserve Works, Calcutta.
13. Haji Tilla Mohammad Bros., Calcutta.
14. A. Kalvert & Co., Bombay
    & Fruit Specialist, Lyallpur, Punjab.
15. G. G. Fruit Preserving Factory, Agra.
16. Indian Canning Industries, Bezwada, Madras.
17. Boral & Sen, Calcutta.
18. Commissioner for Development of Agricultural Marketing, Colombo, Ceylon, and Horticultural Officer, Krishnagar, Nadia.
19. Great Eastern Preserving Works, Calcutta.
20. Rural Products Company, Poona.
21. Raja Ram & Co., Calcutta.
22. Marketing Officer, Beluchistan.
23. B. K. Agricultural Institute, Rajshahi.
24. Fruit Merchants Association,
    12, Ramlochan, Mullick Street, Calcutta.
25. Gwalior Canning Industries, Gwalior.
26. Hindustan Products, Moradabad.

CONTENTS.

		PAGE
1.	Introduction ...	1
2.	The Nutritive Value of Fruits and Vegetables ...	5
3.	Marketing of Fruits and Fruit Products ...	29
4.	Hints on the Manufacture of Jams, Jellies and Marmalades ...	32
5.	Methods of Preservation of Fruit Juices ...	51
6.	Modern Methods in Fruit Canning ...	58
7.	Jams, Jellies and Marmalades from Punjab Fruits ...	65
8.	Fruit Preservation Industry in Bengal ...	76
9.	A Note on the Fruit Preservation Industry in the United Provinces ...	79
10.	Some Suggested Recipes ...	83
11.	Classification of Fruit-plants Grown in India ...	91
12.	Systematic arrangements of the Fruit-plants grown in India	95
13.	Fruit Preservation Industry ...	110
14.	List of Patrons and Office-Bearers ...	123
15.	List of Donors ...	129
16.	List of Exhibitors ...	130
17.	Directory of Manufacturers ...	132
18.	Statistical Tables ...	137

Photo Plates

1. Photo of H. E. the Governor of Bengal, Chief Patron of the Exhibition
2. Photo of the Hon'ble Minister for Agriculture and Industries—President, Exhibition Committee
3. Group Photo of the Members of the General Committee

INDEX TO ADVERTISERS.

Messrs. Boral & Sen ... (i)

" S. A. Rahman & Sons ... (ii)

" S. Wazir Mohammed ... (iii)

" Imperial Chemical Industries (India) Ltd. ... (iii)

" Rural Products Co. Ltd. ... (iv)

" Bengal Canning and Condiment Works Ltd. ... (v)

" Sreekissen Dutt & Co. ... (vi)

" Farm and Fruit Products Ltd. ... (vii)

" A. Kalvert & Co. ... (viii)

" Ideal Fruit Preserving Co. ... (ix)

The Commissioner for development & Agricultural Marketing, Ceylon ... (x)

" Pal's Fruit Products ... (xi)

" Indian Mildura Fruit Farms Ltd. ... (xi)

" Keshandass Kalidass ... (xi)

" Daw Sen & Co. ... (xii)

" Northern India Food Products ... (xiii)

" Roland Canning Co. ... (xiii)

" Hazi Allah Box Md. Yousuf ... (xiv)

" H. Fakirmohamed H. Wazir Mohamed ... (xiv)

" Gwalior Canning Industries ... (xv)

" Dilwar Jan Md. Ariff ... (xv)

" Peer Bukhsh Fazal Rahim ... (xv)

" Abdul Karim Abdul Rahman ... (xvi)

" Tila Md. Fazlal Karim ... (xvi)

" M. Gholam Mahboob ... (xvi)

" Girish Ch. Choubey & Co. ... 90

Fruit and Fruit Products Exhibition, Calcutta, 1942.

GENERAL COMMITTEE.



Sitting L to R—Mr. A. M. Roy, Mr. D. K. Dutt, Dr. B. C. Mukharji, The Hon'ble Nawab Khwaja Habibullah Bahadur of Dacca (*President*), Mr. A. R. Malik (*Hony. Secretary*), Dr K. P Biswas, Mr. K. C. Chakravarty.

Standing L to R—Mr. C. H. Mehta, Mr. A. M Ahmed, Mr. Q. M. Habib, Mr. K. K Bhattacharjee, Mr. T. Hussain, Dr. S. N Chatterjee, Mr I. N. Mahalanobish, Mr. U. N. Boral

Introduction

There is no denying the fact that exhibitions generally serve a very useful purpose of encouraging the production and consumption of the things exhibited and leave their footprints on the sands of time. They are instrumental in bringing new industries into existence or in developing those that may be in their infancy.

Fruit Shows have, ere now, been held in other provinces of India, specially in the Punjab and the United Provinces. The first of its kind to be held in Bengal was the Mango Show held at Malda, in June, 1941, under the auspices of the Marketing Department, Bengal and in close collaboration with the Collector of the district and his staff. That Show was, however, concerned with one fruit only—the mango—and its multifarious products. Exhibits were received from the various districts of Bengal growing this fruit and from other provinces, such as the United Provinces and Bombay. It was opend by the Hon'ble Minister for Agriculture—and enlivened the interest in the problems affecting the production and marketing of this fruit and, as a result, the once defunct Mango Growers Association was rejuvinated.

The genesis of the idea to hold an exhibition which covered all kinds of fruits and their products, took place during the pendency of the above Show. The Government, realising its usefulness, approved the proposal of the Marketing Department which has received the co-operation of the Departments of Agriculture and Industries, and the local Manufacturers. The Corporation of Calcutta kindly permitted the Exhibition to be held in the Town Hall and several non-official public spirited gentlemen made handsome contribution (acknowledged elsewhere in this Brochure) but for which it might have been difficult to organise it.

Notwithstanding the fact that Bengal possesses all grades of altitude, types of soil and degrees of rainfall and climate-conditions favourable for a large production of fruits—the area under fruits and vegetables is not as much as it might be. The demand, however, of fruits and vegetables and their products in the second city in the Empire is so great that it has to be satisfied by imports from various parts of the World. Statistics have been incorporated in this Brochure to show the production of fruits and vegetables in India and Bengal and their imports and exports as also of their products as far as possible.

Recent strides made by the science of nutrition have amply demonstrated that fruits are no longer to be regarded as a luxury for the fortunate rich ; but as a necessity and as correctives for the mal-nutrition caused by their absence in the daily diet of man. The knowledge of the need for a balanced diet or one which is composed of the normal requirements of proteins, fats, carbohydrates vitamines and natural salts is no longer the monopoly of the scientist or a dietician. The layman also wants it and the very useful article by Dr. B. Ahmad of the All India Institute of Hygiene and Public Health, and the tables to be found in the appendices in this Brochure, provide sufficient food for thought.

But fruits and vegetables for whatever they are worth, are only seasonal and must be consumed only when grown unless they are preserved in one form or another. This preservation lengthens the period of availability and benefits both the manufacturer and the consumer. Considerable advances have been made in other countries towards the scientific study of the preserving industry. India has been somewhat behind them ; but much has been done in recent years. An account of the industry in Bengal and the United Provinces will be found elsewhere. It is hoped that this Exhibition will mark a step forward towards a larger realisation of an increased production and consumption of fruits and vegetables and their products.

A word as to the composition of the Exhibition. There are three main groups, namely (1) Fresh fruits and Vegetables, (2) Manufactured products and (3) Other exhibits. Under the first, are four classes consisting of (a) Bengal fruits, (b) Bengal Vegetables, (c) Imported fruits and, (d) Imported vegetables. Those imported may be either from other provinces of India or abroad. Owing to the seasonal availability of certain fruits and vegetables, their actual specimens were not possible to get now. Therefore, models of such have been placed.

In the second group, there are 12 classes for Jams, Jellies, Squashes and Juices, Marmalades, Syrups, Achars and Chutneys, Morabbas, Preserved fruits, Pickled vegetables, Candied fruits, Dried fruits and vegetables and canned fruits and vegetables.

In the third group, there are classes for (a) Labels and Label designs, (b) Posters and Poster designs and (3) Empty Containers -- Bottles, Tins and Cans used for the above products.

The Exhibition Committee has decided to award 3 gold and 24 silver medals for the best exhibits besides Certificates of Merit to the exhibitors. It may be mentioned in this connection that the Metal Box Co. (India) Ltd., has kindly offered to award a silver Cup for the best exhibits, adjudged by the Committee, packed in the cans supplied by the Company.

The Hon'ble Minister for Agriculture and Industries very kindly consented to be the President of the Exhibition Committee. The work of organising the Exhibition was split up into 5 sub-committees, namely (1) Decoration and Stall, (2) Publicity, (3) Accounts, (4) Brochure and (5) Judging. In the appendices will be found the names of the Patrons, Office-bearers and Members of the various Committees. All have contributed whole-heartedly in making the Exhibition successful and must be thanked for their co-operation. Mr. D. K. Dutt of Messrs Sreekissen

Dutt and Co. gave his valuable time to act as Honorary Treasurer and Mr. A. M. Roy M. A., B. Com., F. S. A. A., C. A., kindly agreed to be Honorary Auditor. The Exhibition accounts were kept with the Lloyds Bank.

I must add a word of appreciation for the hardwork put up by the staff of my office, even beyond office hours, to attend to the various preparations, in particular the Assistant marketing officers M/s. T. Hussain and K. K. Bhattacharjee.

A. R. Malik,
(Senior Marketing Officer, Bengal)
Honorary Secretary.

The Nutritive Value of Fruits and Vegetables

By

B. Ahmad,

Joint Secretary, Nutrition Committee, Sanitary Board, Government of Bengal.

The development of the sciences of chemistry and physiology in the beginning of this century revealed that foods which we eat consist of certain definite chemical components which could be grouped under the names, proteins, fats, carbohydrates and mineral salts. The Munich School of Physiologists under the leadership of Carl Voit, which was the centre of learning in the field of nutrition, preached that of the various constituents proteins and calories were most important. Proteins went to build up body tissues and were necessary for body repair while calories represented the amount of energy which all the three groups, proteins, fats and carbohydrates supplied, and a certain minimum quantity of which was absolutely essential for life and work of both man and animals. Fruits and vegetables are very poor in proteins and supply relatively little calories. These were therefore regarded as most extravagant foods. This view was, however, soon to be proved to be very wrong.

About this time a tiny spark was beginning to glow in a new place and within a quarter of a century it was destined to kindle into the biggest fire yet seen in this field. At the Bunge School in Basle Lunin's and Socin's feeding experiments began to throw doubt on the view developed under the leadership of the Munich School that man and animals required only proteins, fat, carbohydrates and mineral, for their normal nutrition. Further support for this came from Pekelharing a Dutch worker and finally

came the convincing evidence from the classical experiments of Hopkins. This was the discovery of vitamins. It was only for a time that the orthodox view of dietary requirements could stand against the oncoming flood of new facts. By the end of the second decade of the present century it was proved that Beri-beri, Scurvy, Rickets, Pellagra which had been responsible for such ravages on man were due to the deficiency of certain essential, formerly unidentified food factors, the vitamins. A new era in nutrition research began and during the next two decades the mysterious and elusive vitamins became definite chemical entities with well defined chemical and physiological properties. The most significant fact of this development was that Fruits and Vegetables which were thought of least value as foods, became most important of all, being the richest sources of those essential nutritional factors, the vitamins.

As this newer knowledge of nutrition developed more and more, the importance of fruits and vegetables became more and more established and Professor E. V. McCollum, one of the top-most experts of this newer knowledge, called fruits and vegetables as "Protective Foods" because they protected from diseases arising from nutritional deficiency. The understanding of the vitamins which fruits and vegetables contained in abundance, and their effects have revolutionised our ideas about nutrition. A large number of diseases have become apparent which simply result from the deficiency of vitamins. Even in diseases other than those which arise from deficiency, nutrition plays an important part. Perhaps the most important fact discovered is that much of ill-defined ill-health and many vague diseases and obscure conditions, are due to a minor deficiency of vitamins in the food. These conditions are relieved so quickly by administration of vitamins that to-day therapeutic dietetics has become an important branch of medicine.

In the wider field of public health, this knowledge of vitamins has proved of the greatest value. It has become

established that malnutrition is at the root of ill healths in the poorer sections of the population. Therefore in every country public health measures are being introduced to provide more and of protective foods to people, particularly to mothers, infants, school children whose needs for these foods are greater. Intensive propaganda is being carried on in progressive countries for the consumption of more fruit, more fresh vegetables as a measure to improve the health of the people. Not only are this protective foods consumed in inadequate amounts by the poor, but even the rich who can afford, eat very little of these. Ignorance of the importance of fruits and vegetables is therefore not confined only to the poor.

In this short article it is proposed to present exact quantitative information on the various vitamins and other essential factors which different fruits and vegetables contain. Before doing so it is necessary to discuss how much of these various vitamins etc, a normal adult needs for normal health. It has been mentioned above that fruits and vegetables chiefly supply us vitamins and mineral salts. Generally speaking they do not supply much of proteins, fats and carbohydrates. Therefore this will not be discussed.

Vitamins :—A large number of vitamins are known to-day. Of these the following are more important :

(i) Vitamin A and Carotene.
(ii) Vitamin B_1 or Thiamin.
(iii) Vitamin C or Ascorbic acid.
(iv) Vitamin D or Calciferol.
(v) Pellagra preventing vitamin or nicotinic acid.
(vi) Vitamin B_2 or Riboflavin.
(vii) Vitamin E or Tocopherol.
(vii) Vitamin K.

1. **Vitamin A** :—This vitamin is necessary for growth and well-being at all ages. If the diet is poor in this vitamin it leads to :

(i) Stoppage of growth in the young.
(ii) Night-blindness.
(iii) Xerophthalmia, Bitot spots and other disorders of the eye.
(iv) Malnutrition of the skin leading to a condition known as phrynoderma or toad skin.

The yellow colouring matter in plants such as carrots is called carotene, which is the mother substance of vitamin A. When animals or humans eat carotene they change it to vitamin A and store any extra amounts in their livers. That is why fish liver oils are so rich in vitamin A. Fish liver oils especially halibut liver oil, cod-liver oil, salmon liver oil, shark liver oil and the liver oils of even river fishes have been found to be very rich. The livers of mammals such as sheep, goats etc, are also rich. Butter, ghee, milk, cheese, egg yolk and cream are good sources.

All green leafy vegetables are rich because they contain carotene, e.g. spinach, turnip, radish, or mustard leaves, cabbage, and all sags. Carrots, mangoes, prunes, yellow peaches are also rich sources.

1-2 mg. of vitamin A are required daily by a normal adult. Carotene which is not so well absorbed as vitamin A should be provided at 2 mg. level.

2. **Vitamin B_1.**--Vitamin B_1 is necessary for growth, good appetite, normal digestive function and proper metabolisms of carbohydrates. Its absence from the diet brings on a disease known as beri-beri.

Whole cereals are rich sources of this vitamin. The vitamin is concentrated in the outer coating of the grain. Hence highly milled cereals e. g. polished rice, white flour are devoid of this vitamin.

Beri-beri occurs chiefly in rice eating people consuming polished rice. Parboiled rice even if polished retain some vitamin B_1.

All dals and pulses are rich sources of this vitamin. However, if water in which rice or dal is boiled is thrown

away most of the vitamin B_1 is lost in the water. Green vegetables contain moderate amounts.

0.75-1.25 mg. of this vitamin are required by the normal adult. This vitamin is easily destroyed by heat, particularly in an alkaline medium.

3. **Vitamin C.**—The lack of this vitamin is associated with scurvy which was very common in the earlier days among sailors during long voyages and among armies during sieges. This disease is characterised by bleeding gums, loose teeth, sore joints, loss of appetite, loss of weight, and fatigue. To-day scurvy is comparatively rare but mild scorbutic conditions are still common. The necessity of having adequate amounts of vitamin C is stressed by all those who recognise the importance of good teeth, maintenance of resistance to infections, and general good health.

Vitamin C is easily destroyed by heat at fairly low temperature and still more easily in an alkaline solution. In acid medium it is more stable.

Some fruits like mangoes, pineapple, guavas, leechi, oranges, limes, lemons, papaya are very rich sources. Among vegetables green leafy vegetables such as, cabbage, mustard leaves, leaves of radish and turnip etc. are rich

25-50 mg. are required daily by the normal human adult.

4. **Vitamin D.**—The mineral elements calcium, phosphorus are required in the building of teeth and bones but unless vitamin D is also provided these tissues will not develop normally and stunted growth and rickets may result.

Rickets attacks children in early age during the period of active bone-growth. The cartilage persists, the bone remaining uncalcified and unable to bear stress, consequently becomes bent and deformed. Conditions of artificial feeding, lack of sunlight and industrial centres are important factors in the aetiology of this disease.

Vitamin D may be provided either as such or simply by exposing the bare body to ultraviolet light or sunshine.

The skin contains a substance (7-dehydrocholesterol) which by the action of ultraviolet light becomes vitamin D. The vitamin D value of foods also increases on exposure to ultraviolet light because they also contain substances which by the action of ultraviolet light change to vitamin D.

Fish liver oils, egg yolk, fish and butter are good sources of vitamin D. Vegetables usually do not contain much but on irradiation with ultraviolet light they become better sources of vitamin D.

0. 0125-0. 025 mg. are required by a normal adult. The requirement, however, depends upon the amount of sunshine enjoyed.

5. **Pellagra preventing vitamin.**—Pellagra is a disease common in certain regions of the world. The early symptoms of pellagra are loss of appetite, loss of weight and general weakness. The more acute symptoms are sore mouth, digestive disturbances, and inflammation of the skin of the hands, arms, feet, legs, face, neck. This disease is due to the lack of a vitamin which has been identified as nicotinic acid. This factor is stable to heat.

Lean meat, liver, butter milk, yeast are good sources. Fresh peas, turnip leaves, tomato juice are also moderately good sources. Maize is very low in this factor. Pellagra has been associated with maize eating people.

6. **Vitamin B_2.**—This vitamin is necessary for growth and general well-being. Like vitamin B_1 it is soluble in water but is stable to heat. Riboflavine as this vitamin is now called is a yellow pigment with a strong green fluorescence.

It is present in whey of milk, egg white, yeast, liver etc. All these constitute good sources. Green leafy vegetables also contain moderate amounts.

7. **Vitamin E.**—This vitamin is essential for reproduction and is known as the antisterility vitamin. Wheat germ is specially rich in this vitamin. Vegetable oils, green lettuce, and a number of other vegetables contain good amounts

of vitamin E. Vitamin E is now identified as alpha-tocopherol and is not readily destroyed by heat.

Many reports are now available, that administration of vitamin E led to successful production in women who had experienced habitual abortions.

8. **Vitamin K.**—This is a fat-soluble vitamin present in many plant tissues. Deficiency of this vitamin increases the clotting time of blood due to reduction in prothrombin an enzyme 'which helps in the clotting of blood. It has been found very useful in many hæmorrhagic conditions. Alfalfa hay and several other grasses are very rich sources of this vitamin.

Mineral Salts.—The human body contains a large number of mineral salts but from the point of view of nutrition calcium, phosphorus and iron are the most important because they are most likely to be deficient in the food.

Calcium and phosphorus are constituents of bone and teeth and give rigidity to the skeleton. Large amounts of these are therefore necessary in the body. Apart from this function both these minerals are essential constituents of body fluids and regulate many important processes without which life would be impossible.

Iron is a constituent of hæmoglobin, the red pigment of the blood and is hence necessary for blood formation. Its deficiency gives rise to anæmia.

The following table shows the calcium, phosphorus and iron requirement by humans.

Table

	Calcium.	**Phosphorus.**	**Iron.**
Adult men	0.75 g.	1.0 g.	10 mg.
Adult women	0.75 g.	1.0 g.	12.5 mg.
Pregnant ,,	1.5 g.	1.5 g.	15.0 mg.
Nursing ,,	1.5 g.	1.5 g.	15 mg.
Children ,,	1.0 g.	1.0 g.	12.5 mg.

These values refer to available calcium, phosphorus and iron and not total.

Effect of cooking on vitamins—Loss of vitamins during cooking takes place in several ways. They may be destroyed by heat and oxidation, and they may dissolve out in the cooking water which is later discarded. The exact extent of these losses depends upon the length of time of cooking, upon the presence of air or dissolved oxygen, and upon the solubilities of the vitamins concerned.

Vitamin B, C, and B_2 are readily soluble in water. Vitamin C is easily destroyed by heat and oxidation. Vitamin B_1 is destroyed by long continued heating but undergoes little destruction when heated at the boiling point of water for as long as one hour. Both vitamin B_1 and vitamin C are more rapidly destroyed in an alkaline medium than in an acid medium.

Vitamin A is insoluble in water and is not readily affected at the ordinary temperatures of boiling and baking. It is destroyed, however, at higher temperatures such as those obtained in frying. It is also destroyed when heated in the presence of oxygen. Vitamin D, B_2 and E are fairly stable to heat and are not destroyed at ordinary cooking temperatures.

The value of any cooked food as a source of vitamins depends largely of course, on its original value in the natural state. Tomatoes are an excellent source of vitamin C even after they have been cooked. This is explained by the fact that during cooking the acidity of the tomato preserves to a great extent its naturally high vitamin C potency. If the tomato were alkaline, much more of this vitamin would be lost in cooking.

In general, it may be said that the destruction of vitamins is less when foods are heated at high temperatures for short periods, than when they are heated at low tempa-ratures for long periods. There is also less loss when a small quantity of water or no water at all is used. For this reason it is recommended that foods be cooked as short a time and in as little water as is practical. If any cooking water is left it should be used for gravies or soups.

Steaming is one of the preferred methods for cooking since the time required is short and the amount of water used is small.

The nutritive value of fruits and vegetables are shown in the following 7 tables :

I. Fruits and vegetables rich in carotene (vitamin A).
II. ,, ,, ,, Vitamin B_1.
III. ,, ,, ,, Vitamin C.
IV. ,, ,, ,, Calcium.
V. ,, ,, ,, Phosphorus.
VI. ,, ,, ,, Iron.
VII. Composition of common vegetables and fruits.

Table I.

Fruits and vegetables rich in vitamin A.

Bengal gram.
Cluster bean.
French bean.
Sund Rai.
Tomato.
Pistachio nut.
Green chillies.
*Coriander.
Cumin.
Persian dates.
*Mint.
*Neem.
Figs.
Jack fruit.
*Ripe mango.
*Papaya ripe.
*Parsimmon.

Plum.
Tree Tomato.
*Betal leaves.
Red plam oil.
*Cabbage.
*Spinach.
Ipomea.
*Puishak.
*Palta shak.
*Amaranth tender.
*Gram leaves.
*Lettuce.
*Parsley.
*Curry leaves.
*Carrot.

*These are excellent sources.

Table II.

Fruits and vegetables rich in vitamin B_1.

*Barley.
*Italian millet.
*Oatmeal.
*Wheat-whole.
*Black gram.
*Green gram
*Lentil.
*Peas dried.
*Groundnut.
*Walnut.
Lettuce.
Parsnip.
Peas.
Cauliflower.
Carrots.
Potatoes.
Beet root.
Raddish.
Leeks.
Colocasia.
Drumstick.
Banana.

*Excellent.

Table III.

Fruits and vegetables rich in vitamin C

*Amaranth tender.
Brussels spout.
*Cabbage.
Celery.
*Coriander.
*Drumstick.
Ipomea.
*Parsely.
Spinach.
Beet root.
Bitter gourd.
Cauliflower.
*Litchi.
Cluster bean.
*Indian gooseberry.
Khol khol.
Turnip.
*Chillies green.
Cape-gooseberry
Guava (country)
Lime.
Lemon.
Orange.
Papaya.
Pine-apple.
Straw-berry.
*Tomato.
Sweet potatoes.
*Cashew apple.

*Excellent.

Table IV

Fruits and vegetables rich in calcium.

*Almonds
*Ricepolishings
Cambu
Singhara (Panifal)
Oatmeal
*Bengal gram
*Black gram
Field bean
*Green gram
*Horse gram
*Lentil
Peas
*Red gram
*Soya bean
String bean
Wheat whole
*Alfalfa
*Amaranth
*Bengal gram leaves
*Carrot leaves
Colocasia stem
*Coriander leaves
*Curry leaves
*Drumstick leaves
Fenugreek leaves
*Garden cress
*Gram leaves
*Ipomoea leaves
*Mint
*Neem leaves
Onion
*Parsley
*Peppermint
*Soya leaves
Spinach
Carrots
Parsnip
*Celery
*Potato
Radish
*Cluster beans
Bitter gourd
Ladies finger
*Gingelly seeds
*Mustard
Dates
Figs
Lemon
Lime
Orange
Radish fruit
*Raisins
*Wood apple
*Tamarind

*Excellent.

Table V

Fruits and vegetables rich in phosphorus.

*Cambu
*Barley
*Cholam
Mint
*Soyaleaves
Beet root

*Maize dry
*Oatmeal
*Rice
*Wheat whole
*Bengal gram
*Black gram
*Green gram
*Lentil
*Red gram
*Soya bean
*Peas, dried.
Amaranth, tender.
Brussels sprouts
Carrot leaves
*Celery
Curry leaves
Drumstick
Garden cress
*Gram leaves
*Colocasia
Onion small
Bitter gourd
Brinjal
Cauliflower
Ladies finger
*Almond
*Cashew nut
*Cocoanut
*Gingelly seed
*Groundnut
*Mustard
Tamarind
Dates
Pomegranate
Radish fruit
Raisins
Wood apple.

*Excellent

Table VI

Fruits and vegetables rich in Iron.

*Amaranth
Carrot leaves
Celery
*Coriander leaves
Drumstick leaves
*Fenugreek
*Garden cress
*Gram leaves
*Neem, tender
Spinach
Bitter gourd small
Gingelly seeds
Tamarind
Pistachia
Cashew nut
Raisins
Apricot
Peaches
Currants
Dates.
*Mint
*Parsley
Soya leaves
Cluster beans
*Mustard
Greem mango

*Excellent.

Table VII

Nutritive value of Fruits and Vegetables.

Name	Protein %.	Fat %.	Carbohydrate %.	Calories per 100 gram.	Calcium mgm. per 100 g.	Phosporus mgm. per 100 g.	Iron mgm. per 100 g.	Carotene (Vitamin A) in ug. per 100 g.	Vitamin B1 in ug. per 100 g.	Vitamin C in mgm. per 100 g.
1	2	3	4	5	6	7	8	9	10	11
Fruits										
Apple.	0.3	0.1	13.4	56	10.0	20.0	1.7	...	120	2
Banana (Plantain)	1.3	0.2	36.4	153	10.0	50.0	0.4	74.4	150	1
Bilmibi (Kamranga)	0.5	0.2	4.8	23	10.0	10.0	0.6	144	...	15.9
Cucumber (Sasha)	0.4	0.1	2.8	14	10.0	30.0	1.5	...	90	7
Mermelo (Bel)	0.7	0.7	16.2	75						7.6
Grapes (Angur)	0.8	0.1	10.2	45	30.0	20.0	0.4	9		3
Guava (Deshi)	1.5	0.2	14.5	66	10.0	60.0	36			56-90
Guava (Peara) hill.	1.0	0.2	8.1	3.8	50.0	20.0	1.2			15
Jack fruit (Kantal)	1.9	0.1	18.9	84	20.0	30 0	0.5	324		10
Lemon (Leboe)	1.0	0.9	11.1	57	70.0	10.0	2.3			39
Litchi (Lichu)	0.68	0.58	13.31	63	6.0	34.0	0.5		42	2.48
Loquet (Loket)	0.7	0.3	10.2	46	30.0	20.0	0.7			1-4.7
Mango (Ripe)	0.6	0.1	11.8	50	10.0	20.0	0.3	288		13
Mangosteen.	0.5	0.1	14.3	60	10.0	20.0	0.2			3.1-11
Orange.	0.9	0.3	10.6	49	50.0	20.0	0.1	120	...	68
Palmyra fruit.	0.6	0	6.5	28	10.0	20.0	0.5			4

Table VII (Contd.)

Nutritive value of Fruits aud Vegetables.

1	2	3	4	5	6	7	8	9	10	11
Papaya ripe	0.5	0	9.5	40	10.0	10.0	0.4	1212	24	46
Peaches.	1.5	0.2	7.6	38	10.0	30.0	1.7	760	—	1
Pears Avacado.	1.7	22.8	0.8	215	10.0	80.0	0.7	—	—	13
Pears (Nashpati).	0.2	0.1	11.5	47	10.0	10.0	0.7	8.4	—	—
Persimon.	0.8	0.2	19.0	81	10.0	10.0	0.3	1026	—	6.1-20
Melon (Futi).	0.35	0.12	3.0	14	17.0	11.0	—	—	—	—
Pine apple.	0.6	0	12.0	50	20.0	10.0	0.9	36	—	63
Plantain red (Martaman kala)	1.6	0.1	23.4	101	10.0	20.0	0.6	210	—	—
Hill plantain.	1.2	0.1	18.0	78	10.0	30.0	0.3	74.4	—	9
Plums (kul).	0.7	0.2	8.9	40	10.0	20.0	5.0	138	120	1
Pomegranate.	1.6	0	14.6	65	10.0	70.0	0.3	—	—	16
Shaddock (Batabi lebu).	0.6	0	10.1	45	300.0	30.0	0.04	120	—	27
Straw berry.	0.7	0.2	9.8	44	32.0	30 0	1.8	—	—	52
Tomato.	1.9	0.1	4.5	27	20.0	40.0	2.4	192	69	31
Water melon.	0.1	0.2	3.8	17	6.0	10.0	0.2	—	—	1
Amla green.	0.44	0.06	12.64	53	22.0	25.0	—	—		413-720

Table VII (Contd.)

Nutritive value of Fruits and Vegetables.

1	2	3	4	5	6	7	8	9	10	11
Cashew apple	0·81	0.6	11.14	—	4.0	20.0	—	0.054	—	261.5
Lime	1.5	1.0	10.9	59	90.0	20.0	0.3	15.6	—	63
Groundnut	7.30	10.92	6.90	155	—	—	—	—	—	0
Cocoanut	1.61	14.31	7.90	167	—	94	2.08	—	—	0
Walnut	3.85	19.92	8.96	211	—	510	2 35	—	—	0
Fruit Products :										
Jam	0.06	—	19 81	79	--	—	—	—	0	0
Marmalade	0.06	—	19.41	78	—	—	—	—	0	0
Dry fruits and fruit products :										
Dates (Khejur)	3.0	0.2	67.3	283	70.0	80.0	10.6	360	90	125
Raisins (Kismis)	2.0	0.2	77.3	319	100.0	80 0	4.0	—	225	—
Tamarind (Tetul)	3.9	0.1	67.4	283	170.0	110 0	10.9	60	150	3
Apricots	1.56	0.09	14.04	63	—	—	—	—	—	0
Currants	0.48	0.09	11.89	50	—	—	—	—	0	0
Fig	0.56	0.14	15.99	67	60.0	30.0	1.2	162	—	2
Prunes	0.85	0.09	11.43	50	—	—	—	—	—	—
Almonds	5.26	15.96	4.30	182	247	442	4.23	—	—	—

Table VII (Contd.)

Nutritive value of Fruits and Vegetables.

1	2	3	4	5	6	7	8	9	10	11
Leafy Vegetables :										
Alfalfa (young leaves)	5.95	0.14	9.51	65	168.0	64.0	7.6	—	—	73-380
"Agathi"	8.4	1.4	8.2	79	1130	80.0	3.9	5400	—	—
Alwan pods (whole)	3.76	0.71	22.34	111	377	200.0	—	—	—	—
Amaranth (tender)	4.9	0.5	5.7	47	500	100	21.4	1500-6600	30	173
Amaranth (spiner)	3.0	0.3	8.1	47	800	50	22.9	—	—	—
Amlu sag	2.8	0.4	4.0	31	129	62	—	—	—	—
Arvi leaves (kachu sag) (small)	6.03	1.13	4.51	53	178	32	—	—	—	—
Arvi leaves (big)	5.42	1.87	5.47	61	471	85	—	—	—	—
Asparagus	3.4	Tr.	2.6	18	25.8	84.5	0.89	—	—	12-71.7
Bamboo (tender shoots)	3.9	0.1	7.5	47	20	90	0.1	—	—	—
Bathua leaves	4.7	0.4	3.7	37	150	80	4.2	—	—	—
Bengal gram leaves	8.2	0.5	27.2	146	310	210	28.3	4020	—	—

Table VII (Contd.)

Nutritive value of Fruits and Vegetables.

1	2	3	4	5	6	7	8	9	10	11
Betel leaves (pan pata)	3.1	0.8	6.1	44	230	40	5.7	5181	—	5
Bharan sag	9.62	0.32	2.92	15	278	110	—	—	—	—
Brussels sprouts	4.7	0.5	9.2	60	50	80	2.3	126	—	72
Cabbage	1.8	0.1	6.3	33	30	50	0.8	1200	150	124
Carrotleaves (Gaujar sag)	5.1	0.5	8.3	58	340	110	8.8	—	—	—
Celery leaves	6.0	0.6	8.6	64	230	140	6.3	3458-4482	—	62
Colocasia stem (kachu danta)	0.3	0.3	4.2	21	60	20	0.5	—	—	—
Coriander leaves (Dhania sag)	3.3	0.6	6.5	45	140	60	10.0	6216-7578	—	135
Curry leaves (gandal pata)	6.1	1.0	16.0	97	810	60	3.1	7560	—	4
Dharubri sag (wild)	4.28	0.64	6.8	50	305	73	—	—	—	—
Dhanki sag	—	—	—	—	—	—	—	—	—	—
Drumstick leaves (Sojne sag)	6.7	1.7	13.4	96	4400	70	7.0	6798	210	220
Feuugreek leaves (Methi sag)	4.9	0.9	9.8	67	470	50	16.9	2316	210	—
Garden cress	5.8	1.0	8.7	67	360	110	28.6	—	150	—
Gheme sag	2.1	—	—	9	160	80	28.8	—	75	—

Table VII (Contd.)

Nutritive value of fruits and vegetables.

1	2	3	4	5	6	7	8	9	10	11
Sorrel ("Gogu")	1.7	1.1	10.0	57	180	40	5.4	—	—	—
Gram leaves (chola sag)	7.0	1.4	11.7	87	340	120	23.8	—	—	—
Hingchi sag	—	—	—	—	182	240	9.35	—	84	—
Ipomoea leaves (kalmi sag)	2.9	0.4	4.3	32	110	50	3.9	1962	87	137
Kachuar (pods dry)	14.44	0.67	56.71	290	540	360	—	—	—	—
Khesari leaves	6.1	1.0	7.6	65	160	100	7.3	360	—	—
Khukuri sag (dried)	30.45	2.5	29.46	262	976	493	—	—	—	—
Keon pods	2.72	0.21	6.87	40	59	103	—	—	—	—
Kulfa sag	2.18	0.4	4.4	30	125	54	—	—	—	—
Kumra sag	—	—	—	—	—	—	—	—	24	—
Lal sag	—	—	—	168	105	35	—	—	—	—
Lettuce	2.1	0.3	3.0	23	50	30	2.4	1320	270	15
Lungru sag	9.62	0.84	1.25	51	40	94	—	—	—	—
Manathakhali	5.9	1.0	8.9	68	410	70	20.5	—	—	11
Mint (Pudina sag)	4.8	0.6	8.0	57	200	80	15.6	1620	—	—
Mustard leaves	1.8	0.26	2.86	22	56	21	1.9	—	—	—

Table VII—(Contd.)

Nutritive value of fruits and vegetables

1	2	3	4	5	6	7	8	9	10	11
Neem leaves	11.6	3.0	21.2	158	130	190	25.3	2736	—	—
Notal sag	—	—	—	—	—	—	—	—	—	—
Onion stems	0.9	0.2	8.9	41	50	50	7.5	—	—	
Palta leaves	5.1			21	60	250	0.8	3720	36	21.6
Papru sag	1.2	0.31	7.61	38	158	45				
Parsley (shulfa sag)	5.9	1.0	19.7	114	390	200	17.9	1920		281
Pepparmint, green	4.55	0.57	5.75	46	203	49				
Pruin sag	1.2				150	430	1.4	1950	120	
Rape leaves	5.1	0.4	7.1	52	370	110	12.5			
Rhelan pods	2.27	0.38	5.33	34	52	50				
Sarson sag	20.91	1.84	34.03	236	2040	500				
Safflower leaves	3.3	0.7	5.1	40	180	60	7.6	3300		
Seol sag	3.52	0.6	4.96	39	390	118				
Soya leaves	6.0	0.5	10.8	72	180	190	8.0			
Spinach (Palang sag)	1.9	0.9	4.0	32	60	10	5.0	1578-2100	70	48

Table VII (Contd.)

Nutritive value of fruits and vegetables.

1	2	3	4	5	6	7	8	9	10	11
Roots & Tubers :										
Beet root	1.7	0.1	13.6	62	200	60	1.0	Traces	210	88
Carrot (gaujar)	0.9	0.1	10.7	47	80	30	1.5	1212-2580	180	3
Colocasia (kachu)	3.0	0.1	22.1	101	40	140	2.1	24	240	Tr.
Mau kachoo	0.75	—	—	20	10				60	
Ol kachu										
Onion, big (bada pyaj)	1.2		11.6	51	180	50	0.7		120	11
Onion, small	1.8	0.1	13.2	61	40	60	1.2	15	120	11
"Onthalaigasu"	1.2	0.1	14.0	62	10	20	0.5			
Paronip	1.3	0.	23.2	101	50	40	0.4	18	315	16
Potato	1.6	0.1	22.9	99	100	30	0.7	24	60	17
Radish, pink (Lal mulo)	0.6	0.3	7.4	35	50	20	0.5	1.8	180	17
Radish, white (sada mulo)	0.7	0.1	4.2	21	50	30	0.4	1.8	180	15
Red potato (Ranga alu)										
Sweet potato (Ranga alu)	1.2	0.3	31	132	2	50	0.8	6	36	24

Table VII (Contd.)

Nutritive value of Fruits and Vegetables.

1	2	3	4	5	6	7	8	9	10	11
Tapioca (Mete alu)	0.7	0.2	38.7	159	50	40	0.9		45	
Turnip (salgam)	0.5	0.2	7.6	34	30	40	0.4		120	43
Yam (elephant) (Chubri alu)	1.2	0.1	18.4	79	50	20	0.6	260.4	60	
Yam (ordinary)	1.4	0.1	27	115	60	20	1.3		72	
Other vegetables .										
Amanant stems (Danta)	0.9	0.1	3.5	19	260	30	1.8	1.3		
Ash gourd (chhachi kumrah)	0.4	0.1	3.2	15	30	20	0.5		63	1
Artichoke	3.6	0.1	16.0	79	120	100	2.3	60	225	
Bajar bang	12.13	9.18	63.25	384	937	292				
Bitter gourd (karela)	1.6	0.2	4.2	25	20	70	6.6	126	72	88
Bitter gourd (Small) (Uchhe)	2.9	1.0	9.8	60	50	140	9.4	126	72	88
Brinjal	1.3	0.3	6.4	34	20	60	1.3	3	45	23
Broad beans (Sim)	4.5	0.1	10.0	59	50	60	1.6			12
Calabash cucumber (Lao)	0.2	0.1	2.9	13	20	10	0.7			
Cauli flower	3.5	0.4	5.3	39	30	60	1.3	22.8	330	66
Celery stalk	0.8	0.1	3.5	18	30	40	4.8			•6

Table VII (Contd.)

Nutritive value of fruits and vegetables.

1	2	3	4	5	6	7	8	9	10	11
Chalta										
"Cho-cho" marrow	0.7	0.1	6.3	29	140	30	0.6			
Cluster beans	3.7	0.2	9.9	56	130	50	5.8	198		49
Colocasia stem	0.3	0.3	4.2	21	60	20	0.5			
Coriander										
Cucumber (sasha)	0.4	0.1	2.8	14	10	30	1.5		90	7
Double beans	8.3	0.3	16.6	102	40	140	2.3			22
Drumstick (sajne danta)	2.5	0.1	3.7	26	30	110	5.3	110.4	210	120
Fern										
French bean	1.7	0.11	4.5	26	50	30	1.7	132.6	78	14
Hog plum (Amrah)										
Indian goose-berry	0.5	0.1	14.1	59	50	20	1.2			413-720
Ipomoea stem	0.9	0.2	3.4	19	80	30	0.8			
Jack fruit seeds	6.6	0.4	38.4	184	50	130	1.2			
"Kandan kathiri"	3.1	0.8	4.8	39	100	90	1.2			
Khaskhas	22.4	44.16	21.0	571	1606	763				

Table VII (Contd.)

Nutritive value of Fruits and Vegetables.

1	2	3	4	5	6	7	8	9	10	11
"Knol-Khol" (Ol-kapi)	1.1	0.2	5.9	30	20	40	0.4	216	—	85
Lady's finger (Deenras)	2.2	0.2	7.7	41	90	80	1.5	348	63	16
Leeks	1.8	0.1	17.2	77	50	70	2.3	18	225	11
Mango(green) (Kacha am)	0.7	0.1	8.8	39	10	20	4.5	90	—	3
Mushrooms (Bengen chata)	13.98	1.67	62.11	328	61	343	8.9	—	—	—
Papaya, green (kacha pape)	—	—	—	—	—	—	—	—	—	—
Potal	1.93	0.3	1.9	18	54	308	1.7	30	20	—
Peas, English	7.2	0.1	19.8	109	20	80	1.5	83.4	360	9
Pink beans	2.4	0.2	6.2	36	40	40	1.2	—	—	28
Plantain flower (mocha)	1.5	0.2	5.0	28	30	50	0.1	—	—	—
Plantain green (kacha kela)	1.4	0.2	14.7	66	10	30	0.6	30	45	24
Plantain stem	0.5	0.1	9.7	42	10	10	1.1	—	—	—
Pumpkin (kumra)	1.4	0.1	5.3	28	10	30	0.7	50.4	60	2
Rape plant stem	3.1	0.1	4.0	29	100	100	1.2	—	—	—
Rhubari stalk	1.1	0.5	3.7	24	120	10	2.2	—	—	37
Ridge gourd (dundhul)	0.5	0.1	3.7	18	40	40	1.6	35.6	66	—

Table VII (Contd.)

Nutritive value of Fruits and Vegetables.

1	2	3	4	5	6	7	8	9	10	11
Snake gourd (cincinga)	1.0	0.13	4.0	21	0.36	50	20	1.3	96	—
Sponge gourd (ghinga)	—	—	—	—	—	—	—	—	—	—
Squash	1.7	—	10.18	49	1.05	31	40	1.1	—	—
Sword beans	—	—	—	—	—	—	—	—	—	—
Tomato, ripe	1.0	0.1	3.9	21	10	20	0.1	79.2	120	32
Vegetable marrow	0.5	0.1	4.3	20	—	30	—	—	—	18
Water chestnut (singhara)	4.7	0.3	23.9	117	20	150	0.8	12	—	—
White gourd (chal kumra)	—	—	—	—	—	—	—	—	—	—

Marketing of Fruits & Fruit Products

BY

A. R. Malik,

Senior Marketing Officer, Bengal.

Ever since the publication in 1928 of the Report of the Royal Commission of Agriculture in India, interest in the various aspects of marketing of agricultural produce has been accentuated. The more one studies the subject, the more ways and means suggest themselves as to the directions in which improvements could be affected.

The practices in vogue are not with regard to any one fruit or in any particular area. Take a package of any fruit that has been in transit for some days and you will find fruits of all sizes and shapes and at varying stages of maturity and ripeness. This may mean that you will find some fruits in the package completely rotten while others have not yet matured. The consequence is that even the good and wholesome portion does not fetch a reasonable price and results in loss to the consignor and dissatisfaction to the consumer.

In this short note, it is, therefore, intended to give some broad principles which should guide the packer if he desires to improve his business and profits.

The Fruit—Fristly, as to the fruit itself.

(1) It is most important that it should be of one *variety*. Even closely related varieties, if packed together, will not attract as much attention as the package containing just one variety. For example Winesep apples mixed with Orange Pippin will not go together.

(2) After the fruits of one variety have been isolated and pooled, the next thing to do is to pick out the defective, diseased, deformed, damaged. discoloured and decomposing fruits. Even if a small speck of rot has made

an appearance, that fruit should be rejected as it will not only wholly rot that fruit but will spread the rot to others also by the time it reaches the destination.

(3) Fruits of one size, texture, colour, taste and stage of maturity should be packed together as far as possible.

The wrapper—Secondly, a word may be said as to the importance of the wrapping paper. With some fruits, of course, it does not pay to wrap each individual fruit, such as litchies, blackberries or plantains ; but when it comes to expensive fruits like Apples, Pears, Mangoes, Peaches, it is worthwhile to wrap them individually. Such wrappers can be and are printed with special designs of the Packer, thereby not only serving as a medium of advertisement but also making the fruit more attractive than when not so wrapped.

Apart from the above advantages, wrappers serve another useful purpose. They can be chemically treated and when a fruit is wrapped in such a paper, it serves to protect it from infection from a neighbour should it have escaped notice at the packing station.

Thirdly, the *packing material* which fills the space between adjacent fruits within a package must be clean, odourless, cheap and one which does not impart its colour to the fruit packed with it. Packing materials usually used for this purpose are cork (used for grapes from Australia), saw-dust, wood-wool and straw.

Fourthly, the *Package*, is of great importance. As far as possible, packages for different kinds of fruits should be of uniform size, depending upon the particular requirements. Standardised sizes are not only pleasing to look at but are very suitable to occupy the space in a Railway wagon or ship's hold most economically and conveniently. The standardisation of sizes of packages also brings down their cost of manufacture to the minimum.

Fifthly, the *label* on the package is the last, but not the least, item on the list. Label should give full details of the kind and variety of fruit contained therein, size,

grade and the nett weight or the number of fruits. It should, preferably, have a coloured design and, of course, the district in which the fruit is grown and the name of the Grower or Packer.

Fruit Products—Regarding fruit products the first consideration is about the raw material itself. Fruit of which a product is to be manufactured must be of uniform maturity, clean and palatable.

Secondly, the preparation of fruit and its processing must be uniformly observed. Once the method of manufacture has been standardised, it must always be adhered to. This will consistently give the same quality of the product which is so very important to the manufacturer who likes to keep his reputation up.

Thirdly, the *container*, be it a bottle or a can, must be of uniform size and scrupulously clean.

Fourthly, the *label* on the container must be of a suitable size and shape and printed in colors with an attractive design. The container and the label are of as much importance as the material inside. A first class product packed in an earthen pot will not fetch the price which it will do if packed in a glass jar or tin can.

Fifthly, there are general considerations of economics of production and manufacture. Such costs must be carefully worked out. To this is to be added the cost of transport, storage and handling charges. A reasonable selling price must have regard to all these and a reasonable profit if the marketing is to be developed.

Lastly, the study of the consuming market is also important. A manufacturer manufactures something to suit the demand and does not push a thing which is not in demand.

In short, when regard is paid to the few broad principles stated above, there will not only be no failure in any enterprise but there will be an ever increasing prosperity instead.

Hints on the Manufacture of Jams, Jellies & Marmalades

*JAMS

Jam is prepared by boiling the whole fruit pulp with sugar (sucrose) to a moderately thick consistency without retaining the shape of the fruit. The United States Government Pure Food Regulations require the use of the not less than 45 pounds of fruit to each 55 pounds of sugar.

Jam may be made from practically all varieties of fruits and from some vegetables. In the United States and in the British Empire the small fruits and berries are most popular for the purpose.

Various combinations of different varieties of fruits can often be made to advantage, pineapple being one of the best for blending purposes because of its pronounced flavor and acidity.

Preparation of the Fruit—Fruit for jam making should have reached full maturity in order to possess a rich flavor and be of the most desirable texture.

All berries must be carefully sorted and washed; strawberries must be stemmed; peaches, pears apples and other fruits with heavy skins must be peeled; while apricots, plums and other thin-skined fruits do not require peeling.

Firm fruits should be boiled in a small quantity of water before sugar is added in order to facilitate pulping. In factory practice it is possible to pulp boiled or steamed fruit in a tomato pulper without previous peeling. Stone fruits, such as plums and apricots, require a very heavy pulping screen because of the abrasive action of the pits. The paddles should operate at moderate speed, so that the pits will not be broken into fine fragments.

---

*"Commercial Fruit and Vegetable Products" by W. V. Cruess.

Berries should not be softened by boiling before the addition of sugar but need only be crushed.

Addition of Sugar—Pure fruit jam as defined by the Pure Food and Drug Regulations contains only fruit and cane sugar. Glucose may also be used but its use must be declared upon the label.

The proportion of sugar to fruit varies with the variety of the fruit, its ripeness and with the effect desired, although the most common ratio of sugar to fruit is pound per pound. This is usually a suitable ratio for berries, currants, plums, apricots, pineapple and other tart fruits. Sweet fruits of low acidity, such as ripe peaches, sweet prunes and Vinifera varieties of grapes, normally require less than an equal weight of sugar and the ratio may in some cases be as low as ¾ pound of sugar per pound of fruit.

Boiling—Boiling is desirable in order to cause intimate mixing of the fruit pulp and the sugar and partially to concentrate the product by evaporation of excess moisture.

Berries should be used in small lots and concentrated to the desired consistency as rapidly as possible. Other fruits are more resistant to the action of heat and may be boiled more slowly or in larger lots.

Steam-jacketed copper kettles are commonly used in commercial practice for the preparation of jams, small kettles being preferred.

End Point—Most jams should be concentrated to a boiling point of 218 to 221°F., the end point varying with the fruit variety, proportion of sugar and other factors. A jelly thermometer may be used with advantage to determine the end point of the boiling process.

Use of Pectin—The combining of fruit pulp with pectin or with apple juice is becoming a more general practice in the commercial manufacture of fruit jams, in order to obtain products of jelly-like consistency.

The use of fruit pectin is of doubtful value, particularly from the consumer's standpoint, because it permits

of great dilution of the fruit pulp with water and sugar and masks the jam-like character of the product.

Vacuum Concentration—Concentration of berry jams in an open kettle results in considerable loss of color and flavor. Experiments and recent commercial developments have demonstrated that a jam of fresh berry flavor and rich red color and in every respect superior to kettle-cooked jams can be made by concentrating the fruit pulp and sugar in a vacuum pan.

The capacity of the vacuum pan will be greatly increased if the fruit and sugar are heated to boiling in an open kettle before entering the vacuum pan. If desired, the vacuum pan may be used as an open kettle when the fruit and sugar are first added. This will be necessary for firm fruits that have not been previously subjected to boiling at atmospheric pressure.

Although greater skill is required in the operation of a vacuum pan than a jelly kettle, the output per man can be greatly increased where vacuum concentration is substituted for the open-kettle method of preparing jams, jellies and preserves and superior products obtained.

Packaging—A great deal of the jams produced in the British Empire is sold in cans ("tins") while in America the glass container is almost universally used for jams, jellies and preserves. The processes of filling and sealing are done by automatic machinery, as described for jellies.

Pasteurizing—If the product contains a very high concentration of sugar (70 per cent or above) it will not spoil in most climates. Most commercially prepared jams are not concentrated to this high density, however, and should be pasteurized at 180°F. for 30 minutes as described for jellies, in order to prevent molding or fermentation.

---

* JELLIES AND MARMALADES

The manufacture of jellies and marmalades is one of the oldest and most important of the fruit products industries, and affords a means of utilizing a large amount of sound cull fruit unsuited to other purposes.

DEFINITIONS

Jelly—Jelly is prepared by boiling fruit with or without water, expressing and straining the juice, adding sugar (sucrose) and concentrating to such consistency that gelatinization takes place on cooling. A perfect jelly is clear, sparkling, transparent and of attractive color. When removed from the glass it should retain its form and should quiver, not flow. It should not be syrupy, sticky or gummy and should retain the flavor and aroma of the original fruit. When cut it should be tender and yet so firm that a sharp edge and smoth, sparkling cut surface remain.

Marmalade—A true fruit marmalade is a clear jelly in which are suspended slices of fruit or peel. Frequently jams are mislabeled as marmalades.

Constituents of jelly—Three substances are essential to the preparation of a fruit jelly. These are pectin, acid and sugar. Of these pectin is the most important.

Pectin—It is possible to make a jelly of excellent consistency by combining pectin, acid, sugar and distilled water in the proper proportions. Fruit juices which are normally deficient in pectin or acid, or both, will make good jelly if these constituents are added. More will be said of pectin later in this chapter.

Acid—Acid is a necessary constituent of fruit jellies. Juices that are deficient in acidity will make good jelly if citric, tartaric or other suitable acid is added, provided the proper proportions of pectin and sugar are present. The effect of various concentrations of acid on the jelling point will be discussed later.

*"Commercial Fruit and Vegetable Products" by W. V. Cruess.

Nature of Jelly—It is probable that the formation of fruit jelly from pectin, sugar and acid is not a stable chemical compound, because if fruit jelly is diluted with warm water the constituents of the jelly go into solution and may be recovered by suitable means. Attempts have failed to obtain the sugar-pectin-acid compound that has been assumed to exist by some.

According to Bigelow, Fremy thought that the formation of jelly is due to the jelling of pectic acid formed during the boiling process, but this theory has been disproved.

Soule states that some fruit juices may fail to give a jelly even if sufficient pectin is present, because of the inhibiting effect of certain colloids. However, he gives no specific data to prove this hypothesis. By means of an ultramicroscope he states that it is possible to demonstrate the presence of a network in starch jellies, and that this network is probably responsible for the jelly-like consistency. He was unable to observe such a network in pectin jellies, although many chemists believe that such a network exists.

Sugar—Sugar, the third necessary constituent of fruit jellies, may be in the form of any of the readily soluble sugars, such as cane sugar (sucrose), dextrose, levulose, maltose, etc. Jelly forms when the concentration (specific gravity) of the solution of sugar, acid and pectin equals or exceeds a certain minimum which varies according to the relative proportions of pectin and acid present. Singh obtained jelly at a concentration of 50 per cent cane sugar when the acidity was 3.05 per cent (as citric) and the pectin concentration was 1.5 per cent. At 0 3 per cent acid and 1.5 per cent pectin, jelly did not form until the sugar concentration reached 61.5 per cent.

Suitability of various fruits for jelly—Fruits for jelly should contain sufficient acid and pectin to yield a good jelly without the addition of these substances. Some fruits contain enough of both pectin and acid for the purpose ;

others are deficient in one or the other of these constituents and others are deficient in both acid and pectin. They may be roughly classified on this basis.

Of the fruits rich in acid and pectin, crab apples, acid varieties of apples, loganberries, sour varieties of blackberries, currants, lemons, limes, grapefruit, sour varieties of oranges, sour varieties of guavas, damson plums, most other varieties of sour plums, labrusca varieties of grapes, sour varieties of cherries, cranberries and roselle are good examples. Of fruits and vegetables low in acid but rich in pectin the following may be cited : sweet varieties of cherries, unripe figs, pie melon, carrots, unripe bananas and ripe quinces. Fruits and vegetables that are rich in acid but low in pectin are apricots, rhubarb and most varieties of strawberries. Fruits which may be classed as containing a moderate concentration of both acid and pectine are ripe Vinifera varieties of grapes, ripe blackberries, ripe apples, loquats and feijoas. Fruits low in both acid and pectin are represented by pomegranates (arals), ripe peaches, ripe apricots and Bartlett pears.

It is customary to blend fruits deficient in acid or pectin, or both, with fruits which have an abundance of the required constituents.

Because it possesses no appreciable flavor of its own, commercially prepared pectin is coming into more general use for the purpose of enriching juices of fruits deficient in this component.

The preparation of jelly The process of jelly making may be discussed conveniently under several operations, namely : those of boiling the fruit, of extraction of the juice, clearing the juice, adding the sugar, boiling, packaging and sterilizing.

Boiling the Fruit--Most fruits should be boiled for extraction of the juice in order to obtain the maximum yield of juice and pectin, because boiling converts pectose into pectin and softens the fruit tissue.

Very juicy fruits, such as berries, do not require the addition of water and need only be crushed and heated to the boiling point for 2 or 3 minutes. For most berries the shorter the period of boiling the better the flavor of the resulting jelly. Firm fruits, such as apples and oranges, are cut or crushed and require the addition of water. Citrus fruits are cut in pieces about $\frac{1}{8}$ to $\frac{1}{4}$ inch in thickness.

The length of boiling will vary according to the variety and texture of the fruit. Apples normally require only 20 minutes or less and oranges from 30 to 60 minutes. The fruit should be heated only long enough to soften it sufficiently to permit thorough extraction of the juice by pressing and not long enough to render it "mushy". Fruit which is boiled too long yields a cloudly juice which is very difficult to filter.

Amount of Added Water—The amount of water that should be added to the fruit should be sufficient only to obtain a good yield of juice and pectin. Juicy fruits require no water; apples from one-half to an equal volume of water, and citrus fruits, because of the long period of boiling necessary, usually require from two to three volumes of water for each volume of sliced or crushed fruit. If too much water is used the resulting juice will be too dilute and will require an undue amount of concentrating before jelly can be made from it; if too little water is used there is danger of scorching the fruit or of obtainig a low yield of juice and jelly. Fruits very rich in pectin, such as currants, loganberries, cranberries, lemons and Labrusca (eastern) varieties of grapes, can be extracted to advantage with two or more succeeding lots of water.

Kettles—The extraction of juice from fruits for the preparation of jelly on a commercial scale is usually accomplished by the use of steam-jacketed copper kettles, placed on a platform or a floor above the press so that cooked pulp and juice may be drawn from the kettle by gravity to the press. If a large kettle (50 or

more gallons' capacity) is used it should be fitted with a large valve (2 inches or larger) to permit drawing off of the fruit. If the installation is of small size a tilting kettle is most convenient.

Effect of Various Metals—Copper injures the color of fruits if contact at the boiling point is prolonged and aluminum is for this reason to be preferred for most fruits. Glass-lined equipment is least liable to cause injury to the color of fruits and should be used for the boiling of citrus and other fruits which may require a long period of boiling. Silver plated steam coils can be used in steam-jacketed, glass-lined kettles to increase the rate of heating. The principle objection to steam-jacketed, glass-lined equipment is its slow conductance of heat, because of the thickness of the walls.

Pressing—The housewife, in preparing juice for jelly making, does not usually press the fruit; she merely places the heated pulp and juice in a cloth jelly bag and allows it to drain, in order to obtain a clear juice.

In the jelly factory a high yield of jelly juice rich in pectin and obtained with a minimum of handing is desired. The use of the rack and cloth press has been found in practice to be one of the most desirable means of pressing the juice from the boiled pulp. The hot fruit and juice direct from the kettle are placed in the cloths of the press and presed.

Use of Pomace—The press cake may, if desired, be mixed with water in the kettle and heated a second time to obtain the remaining pectin. This is probably not advisable for cheap fruits, such as apple culls and apple waste or citrus fruit culls, but may become profitable with more costly fruits, such as currants, loganberries, etc.

The press cake (pomace) has some value as stock food and can be fed directly, or it can be dried, stored and used as needed. It has very little fertilizing value, but can be used to improve the texture of heavy soils

if mixed with lime in order to prevent formation of harmful concentrations of acid in the soil.

Clearing the Juice—Jelly is most attrative when clear and most jelly factories now use mechanical filters.

Filtration—In the Fruit Products Factory at the University of California a small pulp filter is used successfully. Filtration is rapid and the filtered juice is fairly clear, and second filtration renders the juice brilliantly clear. This same type of filter is utilized upon a large scale in many commercial jelly factories.

Filter presses can also be used, but these usually become clogged quickly, unless the juice is mixed with infusorial earth. If from 1 to 3 per cent of a good grade of the earth is mixed with the juice, filtration is fairly satisfactory. The earth forms a filtering layer on the press cloths and thereby reduces sliming or clogging.

For the small jelly foctory, heavy felt jelly bags can be used to improve the clearness of the juice, although it is usually not possible to obtain a brilliantly clear jelly by their use.

Filtration must be accomplished before the addition of sugar, because the latter so increases the viscosity of the juice that filtration becomes extremely slow or impossible. If the juice requires concentration by boiling before the addition of sugar, this should be done before filtering, since boiling causes precipitation of organic matter (probably protein), which should be removed by filtration of other means before sugar is added.

Settling Some fruit juices can be satisfactorily cleared by settling overnight in vessels 1 to 3 feet in depth. Shallow tanks should be used because of the relatively slow rate of settling of juice from boiled fruits.

Finings—Numerous experiments have been made (Cruess and McNair) upon the clearing of jelly juices by the use of fining, but none of the ordinary finings were very satisfactory.

Centrifuging—Recently, experiments with centrifugal clarifiers have proved that jelly juices can be satisfactorily clarified by centrifuging at a high speed, but the Sharpless and De Laval clarifiers being used successfully for the purpose. As much of the coarse pulp as possible should be removed before centrifugal clarification, in order to avoid too rapid clogging of the bowel of the clarifier. This method is rapid and inexpensive in operation and deserves more serious study and attention from jelly manufacturers.

Addition of Sugar—The housewife usually guesses at the amount of sugar that her jelly juice will require, and to juices that she believes rich in pectin she adds an equal or greater volume of sugar, and to juices that she has found by experience to be of poor quality for jelly, less than an equal volume of sugar. Many jelly makers proceed on this same basis.

Pectin Test—A simple and very useful test to determine the proper proportion of sugar to use is the pectin-and-alcohol test, in which a spoonful of the juice and a spoonful of 95 per cent grain alcohol (denatured alcohol will serve the purpose) are mixed in a tumbler. A juice rich in pectin forms a jelly-like mass, one of medium pectin content several large lumps of jelly-like material and one poor in pectin forms a few small pieces of stringy precipitate or no precipitate whatsoever. From the results of this test one can intelligently judge the amount of sugar that may be added to the juice. Thus to a juice containing a large amount of pectin may be added at least 1 cup of sugar per cup of juice ; to that of medium pectin content usually ½ to ⅔ of a cup of sugar per cup of juice, while the juice contaning a small amount of pectin must usually be concentrated by boiling until it will give a satisfactory pectin test. The principal cause of failure in jelly making is the addition of too much sugar. Too large an addition of sugar so dilutes the pectin that jelly will not form. Therefore, the lower the pectin content of the juice the smaller the proportion of sugar should be.

The test must be standardized by experiment against factory practice, since the test at best is only relative, and when so standardized it becomes a valuable means of factory control.

Acid Determination—The acidity of the juice is nearly as important as its pectin content. Titration of a 10-cubic-centimeter sample of the juice with N/10 sodium hydroxide using phenolphthalein indicator, is a satisfactory means of determining the acidity. It is generally necessary to dilute the sample with about 100 cubic centimeters of distilled water, in order to make observation of the end point accurately. The acidity of the juice should be such that the finished jelly will contain at least 0.5 per cent total acidity, but preferably 0.75 to 1 per cent. Juices of low acidity can be made into jelly without increasing the acidity, but an excessive amount of sugar or boiling will be necessary. It is usually more economical to increase the acidity of such juices by the addition of citric or tartaric acids or by the addition of a juice of high acidity.

The sugar should be weighed carefully and the volume of the juice accurately measured. If the volume of the kettle is known, it can be filled to a given height and actual measurement of the juice avoided. Measurement of the sugar by weight rather than by volume is desirable because of the greater accuracy of the former method.

It is not necessary to heat the sugar before it is added. It must be stirred with the juice in the kettle to avoid sticking and burning.

Boiling—Boiling is one of the most important steps in the jelly making process, as it dissolves the sugar and causes union of the sugar, acid and pectin to form jelly. It usually causes a coagulation of certain organic compounds which can be skimmed from the surface during boiling, and their removal renders the jelly clearer. Its principal purpose is to increase the concentration of the sugar to the point where jelling will occur.

The boiling operation, while normally a necessary step in jelly making, should be as short as possible. Prolonged boiling results in loss of flavor, injury to color and hydrolysis of the pectin, and is a frequent cause of jelly failure.

Kettles—Boiling in commercial practice is usually conducted in open steam-jacketed, copper kettles which may or may not be lined with tin or silver. Large kettles are less desirable than small ones, for the reason that the boiling process must be unduly prolonged in the larger vessels with consequent injury to flavor and color. Therefore, 25-and 10-gallon kettles are to be preferred to 50-or 110-gallon kettles. Boiling the juice in small lots permits more rapid boiling without danger of loss by frothing than is the case when the kettle is filled to capacity.

Skimming—During boiling the juice should be skimmed if necessary in order to remove coagulated material and should be stirred to cause thorough mixing.

End Point—The boiling is continued until on cooling the product will form a jelly of the desired consistency. The concentration of the mixture when this point is reached will depend upon several factors, namely, the concentration of pectin, the concentration of acid, the ratio of sugar to pectin and acid and the texture desired. If the jelly is to be shipped long distances and subjected to rough handling, it must be stiffer than if it is to be stored on the pantry shelf at once or to be delivered to local dealers. In general, the finished product should be of the consistency described in the definition of jelly at the beginning of this chapter.

The most common method of determining the end point is by allowing the liquid to sheet from a wooden paddle or from a large cook spoon. If it drips from the instrument as a thin syrup the process is not complete ; if it partly congeals and breaks from the paddle or spoon in sheets or forms jelly-like sheets on the side of the paddle or spoon the boiling is considered to be complete. The

sheeting test is, however, subject to error because of the personal equation and because of variation in behavior of different lots of juice.

A more accurate method of determining the jelling point is by the use of a thermometer inserted in the boiling juice. If the juice contains the proper proportions of sugar, acid and pectin, the boiling point of the liquid at the jelling point will normally be about 8 to 9°F. above the boiling point of water. At sea level this will be at 220 to 221°F. and corresponds to a concentration of 65 to 70 per cent total solids in the jelly after cooling. It is also possible to use a hydrometer test on the hot liquid in order to judge the end point. A Balling or Brix hydrometer is suitable for the purpose but if the test is made on the juice near the boiling point the Balling or Brix degree should be approximately 58 to 60°, corresponding to about 65 to 67° Brix or Balling at room temperature. The thermometer and hydrometer tests should be confirmed by the sheeting test, since the juice may be so poor in pectin or acid that jelling will not occur until a greater concentration is reached that given above, or so rich in these constituents that the jelling point is reached before a concentration of 65° Balling is reached.

If the jelly is to be preserved by pasteurization, the final concentration need not be as great as when the product is preserved by a high concentration of sugar. The housewife usually relies upon high sugar concentration to preserve her jelly, while the commercial manufacturer usually pasteurizes his product in hermetically sealed containers.

CAUSES FOR FAILURE IN JELLY MAKING

Too Much Sugar—The usual cause for failure is the addition to the juice of too much sugar in proportion to the pectin and acid of the juice. Firm jelly can be obtained by properly adjusting the proportion of sugar to the pectin and acid as previously determined by the alcohol test for pectin and by titration of the acidity.

Prolonged Boiling—Too prolonged boiling results in the hydrolysis of the pectin and in the formation of a syrupy caramelized mass that will not jell. The juice and sugar should be concentrated to the jelling point as rapidly as possible in order to avoid hydrolysis of the pectin.

Crystals—At ordinary temperatures jelly develops sugar crystals if the concentration of the finished product exceeds 70° Balling. During the normal boiling of jelly some of the cane sugar is hydrolyzed to dextrose and levulose, which exhibit less tendency than cane sugar to crystallize.

Crystals of cream of tartar form in grape jelly, but this tendency can be reduced if before the addition of sugar the juice is concentrated by boiling and allowed to deposit its excess cream of tartar in storage. It may also be diluted with water and fortified with commercially prepared pectin or with other fruit juices to the point where crystallization does not occur when jelly is prepared.

PREPARATION OF MARMALADES

A good marmalade should be a jelly with pieces of fruit suspended therein and should not be merely a jam or butter. The principles of jelly making, therefore, apply also to the preparation of marmalades.

Types of Marmalade—English and Scotch marmalades are usually made from the bitter varieties of oranges from Spain, grown principally in the vicinity of Seville. In America sweet varieties are used.

English Marmalade—The fruit from which the English type of marmalade is produced is high in both acid and pectin and no difficulty is experienced in obtaining a firm jelly-like marmalade from it.

The fruit may be shipped in boxes or in bulk to the factories in England, or it may be shipped in barrels in

brine or in cans sterilized in sliced or shredded form in its own juice. The last named method is successful and probably the most satisfactory.

American Marmalade—In the United States, marmalade is usually made from cull oranges of the shipping varieties, such as the Navel and Valencia. The product is characterized as "sweet marmalade" as distinguished from the bitter English marmalades. The sweet oranges grown in California and Florida for the fresh market are usually somewhat deficient in acid or pectin, or both, when allowed to ripen thoroughly. It is, therefore, usually desirable to mix grapefruit or lemons with the oranges, in order to furnish pectin and acid. Marmalade in which grapefruit is used in bitter and resembles the English product to a small degree. Those who have been accustomed to the English marmalade prefer the orange-grapefruit type to the orange-lemon type of marmalade, but the average American consumer usually prefers the sweet marmalade,

Deciduous Fruit Marmalades—Marmalades are also made from other fruits, although many so-called marmalades are jams rather than marmalades. Various sliced fruit can be mixed with a juice rich in pectin and sugar in preparing a true marmalade, *i.e.*, a jelly in which are suspended pieces of fruit. The famous "bar-le-due" of France is essentially a marmalade prepared from currants.

Preparing the Juice for Marmalade--According to the usual American factory practice in making marmalade the juice and the sliced fruit are prepared separately and are not mixed until the final boiling of the juice and fruit with sugar.

Slicing—In preparing a marmalade from oranges and lemons these fruits are mixed in the proportion of about 1 pound of lemons to 4 to 10 pounds of oranges and sliced about 3/16 inch thick. Ripe fruit of both varieties is used. In investigations by Lal Singh it was proved that

better results are obtained if the ratio of lemons to oranges is increased to equal weights of the two fruits. The flavor is more pleasing and a higher yield of finished product is obtained with this increased proportion of lemons.

Boiling—The sliced fruit is covered with two to three times its volume of water in a jelly kettle (glass-lined equipment is to be preferred) and the mixture is boiled until the fruit is tender, usually about 1 hour. It is sometimes necessary to add water during boiling to replace that lost by evaporation.

The hot pulp is then pressed in a rack and cloth type of press. Heavy cloths or two thickness of ordinary press cloths should be used in order to eliminate as much of the fine fruit pulp as possible.

Filtration—The juice can be cleared by settling in shallow vessels for 24 hours or by filtration through filter pulp. Felt bag filters yield a juice which is opalescent but which, nevertheless, produces a marmalade of satisfactory appearance.

Analysis of Juice—The juice should be tested for acidity and pectin ; should give a good pectin test and should contain at least 1 per cent of acidity expressed as citric acid. It is possible to use the Balling test as a method of factory control in derermining the suitability of the juice for marmalade manufacture. If equal weights of lemons and oranges have been used, the juice should test about 6° Balling at 15.5°C. (60°F.), if it is desired that an equal weight of sugar and juice be used.

Grapefruit equal to 10 to 25 per cent of the weight of oranges used is frequently mixed with the latter fruit in the preparation of juice for bitter marmalade.

Preparing the Sliced Fruit For the preparation of the English marmalade the whole fruit is used and the

juice and peel are not prepared separately. The fruit is very finely shredded by a special machine designed for this purpose.

Three methods of preparing the peel are in use in marmalade factories in California. In one method a band of peeling about 1 inch wide is cut from the orange around its greatest circumference. This band is then cut crosswise into very thin slices about 1/32 of an inch thick. The pieces possess a "shoe peg" appearance and give a very attractive marmalade.

In an other method the whole fruit is sliced very thin and boiled until tender. It is then placed on screens and the white pulp is washed from the peels by a spray of water.

In one large factory the whole fruit is chopped finely by means of a mechanically driven mincemeat chopping bowl. No attempt is made in this case to prepare the juice and peel separately, in this respect resembling the English process. Marmalade prepared according to this method is cloudy and of jam-like rather than jelly-like consistency, but is of excellent flavor.

The writer prefers the second process, because of its convenience and of the attractive appearance of the finished marmalade.

Boiling and Packing—In the usual process in California factories the juice and peel are combined after the latter has been boiled in water until tender The proportion of peel to juice will depend upon the pectin content of the juice and upon the thickness of the peels. Where the slices are very thin and the juice is rich in pectin about 5 to 7 per cent of the sliced peels may be added to the juice together with an equal weight of sugar. If the slices are relatively thick a larger proportion by weight of peel can be added.

Where the whole chopped or sliced fruit is used without previous separation of the peel and juice, the fruit should be boiled until tender before sugar is added.

Addition of Sugar.--The amount of sugar that is required varies greatly with the composition of the juice and, as in jelly making, a relatively greater proportion of sugar can be added to juices rich in pectin and acid than to those deficient in one or both of these constituents. Equal weights of juice (*i.e.*, juice and fruit) and sugar is the normal proportion.

End Point.-The juice, peel and sugar or sugar and sliced or chopped whole fruit are boiled to the jelling point, usually 220 to 221°F. The tests previously described for determining the finishing point of jellies can be used in the case of marmalades. A good marmalade should not be syrupy, but should be of jelly-like consistency.

Cooling.—Marmalade should be allowed to cool partially and to stand a short time to permit absorption of sugar by the peel from the surrounding syrup before the marmalade is placed in the final containers, unless the whole fruit is used without previous separation of juice and peel. If packed boiling hot direct from the jelly kettles the peels are apt to come to the surface instead of remaining in suspension.

Flavoring.—The boiling of marmalade removes a great deal of the orange oil from the peels and the finished product, if made from commercial sweet varieties of oranges, is liable to be lacking in distinctive flavor. A small amount of orange oil or orange extract added to the marmalade and mixed with it thoroughly after the boiling has been completed will usually considerably improve the flavor.

Pasteurizing.--The marmalade should be sealed in glass or tin at about 150 to 180°F., as described elsewhere for jellies. Vacuum-sealed containers are best for the purpose, because they reduce the tendency of the product

7

to oxidize. They should be pasteurized in water at 180°F., as described elsewhere for jellies.

Other Marmalades.-Excellent marmalade can be prepared by combining apple juice rich in pectin and acid with thinly sliced firm peaches, or figs similarly prepared or with other firm fruits. The juice and sliced fruit can be mixed with sugar and concentrated to the jelling point in the usual manner.

*Methods of Preservation of Fruit Juices

Several methods are in commercial use for the preservation of fruit juices. The most important of these are discussed below : --

Pasteurization—Pasteurization as applied to fruit juices means the destruction, by heat, of all microorganisms capable of increasing in the juice and of causing spoiling. It usually does not kill the spore-bearing organisms, such as B. *subtilis*, B. *mesentericus*, etc., but these organisms and most other spore-bearing bacteria as well cannot grow in acid fruit juices and consequently their presence is of no practical significance. Pasteurization of still (non-carbonated) juices need only be at such a temperature and for such a time that yeasts and molds are destroyed. Yeast is killed by heating for a few minutes at 150°F. and resistant mold spores will require in most cases a temperature of 175°F. for 20 minutes. Molds require oxygen for growth and for this reason heavily carbonated juices can be pasteurized safely at 150°F., which destroys yeast cells. Most still juices must be pasteurized at 175°F. ; juices of high acidity may be pasteurized at a lower temperature, 160 to 165°F.

Effect of Carbon Dioxid—Experiments have been made by J. H. Irish and the writer upon the effect of carbon dioxid upon pasteurizing, in which it was found that carbonating at from 10 to 60 pounds pressure did not noticeably reduce the death temperature of typical fruit juice organisms, such as yeast, mold spores, B. *coli*, B. *subtilis*, etc. The carbon dioxid, however, prevented growth of surviving mold spores. It was found that 30 minutes pasteurization at 65°C. (149°F.) in all cases

*'Commercial Fruit and Vegetable Products'—by W. V. Cruess.

prevented subsequent development of yeast in samples heavily inoculated before pasteurization.

Bulk Pasteurization--It is often necessary to store fruit juices in bulk in large glass carboys or in barrels to permit settling or shipment in bulk. Two types of pasteurizers, which may be designated as (1) continuous and (2) discontinuous, are used for this purpose.

The continuous pasteurizer consists of a single metal tube or series of small metal tubes, through which the juice flows and is heated to the desired temperature by a steam or hot water jacket. Block, tin, aluminum and silver-lined copper are commonly used for the purpose.

Heating by Steam—The use of steam is somewhat objectionable because it does not permit of very exact regulation of the temperature and is liable to cause scorching or overheating of the juice.

Heating by Water—If the heating tubes of the continuous pasteurizer are surrounded by water it is possible to regulate the temperature very closely. The temperature of the water surrounding the heating tubes need not be more than 3°C. (about 6°F.) above the temperature of the juice, and therefore there is little danger of overheating the juice.

Discontinuous Pasteurizers –The discontinuous pasteurizer consists of a steam-jacketed kettle, or of a tank equipped with steam coils, in which the juice may be placed and heated to the desired temperature. It is objectionable because it is liable to cause local overheating of small portions of the juice in contact with the heating surface, exposes the juice to the air and oxidation during pasteurization, and to prolonged heating with injury to color and flavor.

Flash Pasteurization—Under usual factory conditions the juice in bulk pasteurization is passed while still hot directly into sterile barrels or large bottles for storage, and remains hot in the barrels for 24 hours or longer and in the bottles for 5 or 6 hours. This prolonged

heating results in considerable injury to the flavor and the color of the product.

Chace has devised a means of chilling of the juice immediately after pasteurization by passing the cooled juice under aseptic conditions into sterile containers, preferably bottles, and sealing the containers with sterile corks or caps. Great care must be employed in order to avoid infection of the juice with mold or yeast, and it is doubtful whether the process will have wide application in factory practice. A temperature of 180 to 185°F. (about 82 to 85°C.) is used for a few seconds only, and therefore the juice suffers very little injury to flavor or appearance.

Pasteurization in Bottles and Cans—After the juice has been filtered or otherwise treated to prepare it for bottling or canning, it is sealed in the final container and pasteurized, usually by immersion in water, which is heated to the desired temperature and for the desired length of time. One form of bottle pasteurizer consists of a shallow wooden vat fitted with a steam coil and a perforated false bottom on which the bottles are placed in a horizontal position, covered with water and heated to the pesteurizing temperature.

In large establishments continuous pasteurizers are used in which the bottles of juice are carried by a basket conveyor progressively through baths of water of increasing temperature and through baths of water of decreasing temperature to cool the juice.

Heat may also be applied to the bottled juice by sprays of water circulated by a pump. The temperature may be regulated so that the bottles are heated gradually to the pasteurizing point and cooled slowly by gradually reducing the temperature of the water, so that breakage is reduced to a minimum.

Relation of Factory Sanitation to Pasteurization—Investigations at the University of California have demonstrated that the temperature necessary for pasteurization

varies with the mass of tne infection of the juice with yeast or mold.

Therefore all possible precautions should be taken to exclude micro-organisms from the juice at all stages of the process. Press cloths unless washed immediately after use and dried at once will become "sour", *i. e.*, infected with large numbers of yeast cells and mold spores. The lines, pumps, tanks, filling machines and all other equipment that come in contact with the juice must be kept scrupulously clean and steam or hot water used frequently and generously in the cleaning and sterilizing of such equipment. Crushers are particularly liable to develop yeast and mold if not throughly cleaned after use.

Bottles, cans and bottle caps should be sterilized before use, caps in particular being a very prolific source of mold infection in bottled beverages.

Preservation of Fruit Juices by Chemical Preservatives—Although it is not an ideal method of preservation, large quantities of apple juice are preserved with benzoate of soda. Other fruit juices are sometimes preserved with sulphurous acid.

Benzoate of Soda (and Bensoic Acid)—The active preservative principle of benzoate of soda is the benzoate radicle, not the sodium ion. The salts of benzoic acid are more readily soluble than the acid, and for this reason the sodium salt is employed in preference to the acid.

The percentage of sodium benzoate that may be used in the preservation of foods was at one time limited by pure food and drug regulations to 1/10 of 1 per cent but at the present time more than this amount may be used, provided the label bears a statement giving the percentage contained in the produce. Fruit juices can, in practically all cases, be preserved satisfactorily by the addition of 15/100 of 1 per cent of the benzoate. The benzoic acid exerts a selective action upon the organisms found in sweet cider, often

preventing the growth of yeasts and molds, but permitting the development of vinegar and lactic acid bacteria.

Carbonating increases the toxicity of benzoic acid upon the spores of *Bacillus subtilis*, as shown by recent investigation by J. H. Irish on the carbonating of grape juice.

Sodium benzoate possesses a disagreeable "burning" taste that is readily perceptible in juice containing 1/10 of 1 per cent of the benzoate.

Sulphurous Acid—Fruit juice can be preserved for more than a year by the addition of 1/10 of 1 per cent of sulphurous acid (1,000 milligrams per liter, or 1,000 parts per million), provided the juice is made from sound fruit and stored in clean containers at a temperature not above 60°F.

Sulphurous acid is very much more toxic to mold spores and vinegar bacteria than it is to yeast, in this respect differing from benzoic acid, which is more toxic to yeast than to vinegar bacteria. The following table summarizes the result of experiments made to determine the relative toxicity of sulphurous acid upon yeasts, molds and bacteria.

Table 39—Selective Action of Sulphurous Acid upon the Microorganisms Occurring in Fruit Juices.

(Organisms given in number per cubic centimeters)

Organisms	Number of organisms in untreated juice.	Number after 36 hours' exposure to 50 mg. SO per liter.	Number after 36 hours' exposure to 100 mg. SO_2 per liter.	Number after 36 hours' exposure to 200 mg. SO_2 per liter.	Number after 35 hours' exposure to 400 mg. SO_2 per liter.
S. ellipsoideus (wine yeast)	20,000	640,000	2,000,000	310,000	36,000
S. apiculatus (wine yeast)	150,000	200,000	75,000	56,000	...
Penicillium mold	120,000	40,000	..	...	...
Bacterium aceti	310,000	14,000	300	...	...

Fruit juice may be preserved temporarily (from several days to 2 or 3 weeks) with concentrations of sulphurous

acid considerably less than 1/10 of 1 per cent and small amounts of this preservative are often useful in preventing fermentation of juice during 1 or 2 days' settling after pressing, in order to aid in clearing. For this purpose 100 milligrams per liter (.01 per cent.) of sulphurous acid is usually sufficient and does not noticeably affect the flavor of the product.

Sugar as a Preservative—All fruit juices may be preserved by the addition of sugar or by increasing the natural sugar content of the juice by concentration. Such products are, however, fruit syrups and will be discussed fully in the chapter on syrups.

Preservation by Low Temperatures—When stored at 32°F. (0°C.), the temperature ordinarily employed in the cold storage of fruits, fruit juices either become moldy or undergo fermentation and in order to prevent the growth of microorganisms it is necessary to use tempara-tures below 25°F.

In experiments at the University of California it was found that grape juice, apple juice and berry juices could be held for at least 2 years at temperature of 10 to 15°F. (about 5 to 8° below 0°C.) without noticeable loss of flavor, aroma or color, where the juices were stored in sealed containers, such as lacquered tin cans or in bottles. The juices were not pasteurized.

It is believed that this method could be applied upon a commercial scale with marked increase in the consumption and popularity of unfermented fruit juices.

Recently fruit juices have been preserved by cold storage for shipment over a distance of 500 miles in glass-lined tank cars by precooling the juice to about 28°F. and placing it at once in well insulated tanks of several thousand gallons' capacity each.

Preservaion by Pressure—Hite, Giddings and Weakley found that grape juice in active fermentation could be sterilized by subjecting it to a pressure of 75,000 pounds per square inch for 30 minutes and by a pressure of 30,000

pounds per square inch applied for a somewhat longer time. Apple juice was sterilized by 60,000 to 80,000 pounds pressure per square inch applied for 30 minutes, and actively fermenting sugar solutions were sterilized by 60,000 pounds pressure in 30 minutes.

In their experiments a small collapsible tin tube was filled with the fruit juice or other liquid and the tube was sealed. The tube was then placed in a lead cylinder, which in turn was placed in a heavy-walled steel cylinder into which water or oil was forced by hydraulic pressure. In some of their experiments a pressure of 110,000 pounds per square inch was used.

The experimenters state that fruit juices preserved by this method were equal to the fresh fruit in flavor and general quality, and that it would be feasible to build a machine in which juice could be sterilized in containers of larger size than those used in their experiments.

Preservation with Carbon Dioxide —Fruit juices have been successfully preserved by special methods of carbonating. In the Ruef process the fruit is first filtered through a porcelain filter to remove most of the yeast cells, and is then carbonated under aseptic conditions and bottled in sterile bottles. The method has not been applied commercially because of the great difficulty of completely excluding microorganisms.

In the Frank process, now in use for the preservation of "near beer", the liquid is placed in a heavy keg or other suitable container and subjected to a vacuum to withdraw most of the air from solution in the liquid. The liquid is then carbonated to a moderately high pressure, above 60 pounds per square inch, and is, after standing a short time, again placed under a vacuum and carbonated a second time. It is claimed that the repeated carbonating and treatment under vacuum destroys the microorganisms which would otherwise cause spoiling of the product.

Modern methods in fruit canning*

The procedure generally adopted in modern fruit canning may be shown in the accompanying diagram

Preparation of the fruit	Grading	Packing into cans	Syruping
Exhaust	Sealing	Sterilising or processing	Cooling
	Stacking	Lebelling and boxing	

The fruit is prepared, graded by hand or machinery and packed into the cans. The next process is one of adding the syrup, but before mentioning the machines used for this purpose it is essential to say a few words about the syrup. In fruit canning, sugar syrup is used for the following reasons :

1. It tends to retain the natural fruit flavour.
2. It inhibits to some extent the decomposition of the antho-cyanin colouring matter of the fruit.
3. It toughens the tissues, and therefore helps to keep the natural shape of the fruit during processing and subsequent transportation.
4. It aids materially in sterilisation by allowing convection currents to be set up, and thus the heat is transferred quicker to the centre of the can than would be the case if conduction was relied upon.

The syrup should be prepared from the best grades of granulated sugar, either cane or beet. The sugar is dissolved in water to give the requisite density of syrup, and

*F. Hirst, M.Sc., A.R.C, Sc., in "Food Manufacture", June 1929.

the water used should be of good drinking quality, low in mineral salts and free from any suspicion of sewage contamination. If very hard water is used for making syrups the latter may become cloudy after the cans are processed. Sulphates and iron salts are also objectionable. The syrup is generally prepared in enamel-lined or copper tanks. If the former type are used they are fitted with steam coils, whereas copper vessels may have a coil or be steam jacketed to enable the sugar to be dissolved quickly in the water. Wooden tanks should not be used as they tend to become impregnated with spoilage micro-organisms. The syrup should be clarified by passing it through, flannel muslin or fine brass wire gauze before it is used to fill the cans.

Density of syrup—The best strength of syrup to use is one which brings out the full flavour of the fruit without making the product too sweet.

Syruping Machines—There are various types of automatic syruping machines and most of them operate very much on the same lines. As the can enters the syruping machine it is lifted by camaction which in turn causes a valve to open and syrup from a small reservoir to enter the can, the displaced air at the same time escaping through a vent.

Exhaust—This term is used in canning for the operation of heating the cans before they are hermetically sealed. The most important object of exhausting is to remove air from the cans before they are sealed, and thus to produce a vacuum after the cans have been sterilised and cooled. The vacuum causes the ends of the can to be drawn in, and the concave ends thus produced indicate to the prospective purchaser that the contents of the can are sound. Exhausting serves another useful purpose in that it prevents overfilling of the cans. The heating causes the can contents to expand and as the contents contract on cooling sufficient head-space is left. When open top caps are sealed at too low a temperature they may become springers or swells if subjected to a fairly high temperature. Several

examples of springers have been found to be due to over-filling. The internal pressure set up in a can during sterilisation will vary according to the difference in temperature at which it was sealed and the temperature attained in sterilisation ; the higher the temperature at which the can is sealed, the less will be the interval pressure in the can and the greater will be the vacuum.

In America tremendus losses result every year from what are known as hydrogen swells and springers. These are due to the action of the fruit acids on the metal of the can producing hydrogen gas in sufficient quantities to cause the ends of the can to spring or to become convex. An extreme effect of chemical action on the tin plate is the production of perforations or pin holes.

Removal of oxygen The corrosion of the tin plate is greatly accelerated by the presence of O_2 in the can, and the object of the exhaust process is to remove the gas as far as possible, not only from the head space of the can but also from the intercellular spaces of the fruit. It has been shown that the most satisfactory method of removing the residual O_2 in fruit is by employing a long exhaust at moderate temperature rather than a short exhaust at a high temperature. Unfortunately, even with the most efficient methods of exhaust there is always the possibility of corrosion taking place through the agency of the natural coloring matters of the fruit, but this danger may be reduced to a minimum if care is taken to drive of the air at this important stage of the canning operations.

It is of interest, however, to note that in an investigation on the protective action of various types of lacquers undertaken in 1927 at Campden, a large number of the cans packed with various kinds of fruit were held in store for at least 18 months without the appearance of a single hydrogen swell or perforation. No special care had been taken to remove the last trace of air from the cans, but the lacquer coating in every case had originally been sound.

Exhaust boxes—There are two types in use in British canneries. In the Ayras pattern the cans are fed from the syruping machine in a straight row on to a disc which revolves and places the cans on a carrier chain. The disc having the greater speed fills the chain with cans, and the latter are then carried through the box, the bottom of which is filled with hot water. The track inclines gradually from each end, so that the lower part of the cans pass through the hot water. The upper half of the box is heated by means of a closed steam coil. The cans pass out of the exhaust box on to another disc, which passes them on singly to the closing machine.

Another type used in modern canneries is the Anderson-Barngrover. This consists of a rectangular box in which there are a number of rows of metal discs. These inter-mesh and the cans are guided through hot water or steam by means of curved iron bands. A water exhaust of this type is very efficient as the cans are carried through the hot water along the whole of their path and the water reaches almost to the tops of the can.

In both types of exhaust boxes, temperature controls can be fitted so that all the cans get exactly the same heat treatment whilst passing through the exhaust box.

Sealing—From the exhaust box the cans pass at once to the sealing machine, which spins on the lids. There are many automatic sealing machines, but the principle of seeling is the same in almost all the types. The actual sealing of the cans is carried out by means of two small rollers which are brought into operation one after the other. The first roller folds the edge of the lid round and under the lip of the can, and the second roller tightens the joint. Sealing the cans is one of the most important operations in canning and whichever type of machine is installed its working should be thoroughly understood by the operators. He should be able to examine a seam and know if his machine is working properly.

The process of sterilisation—The success of any method for the destruction of micro-organisms depends on killing the cell-protoplasm. This is susceptible to certain chemical and physical agents, and of the latter heat has been found to be one of the most effective. Heat alone if applied long enough will destroy the protoplasm, but a combination of heat and moisture is far more deadly. In practice the contents of the can are covered with a sugar syrup, and the heat thus acts in the presence of moisture. *The canning process is therefore a method of sterilisatiou depending on moist heat.* Absolute sterility is what the canner desires, but this is not always achieved. The heat treatment given, however, must be sufficient to kill or at least inhibit the growth of micro-organisms. It has another purpose, and that is to improve the texture and flavour of the product by cooking.

It should be clearly understood that in sterilising the cans after they have been closed, the canner is concerned with killing the micro-organisms originally present on the fruit and also in the water used in making the syrup. This is done by heating the cans for a certain time at a suitable temperature. It is thus a time operation, and as a general rule the higher the temperature used, the shorter the time of exposure. The times and temperatures are a matter of experience and experiment. It is quite conceivable that if there are more bacteria or yeast present than is usual, the times and temperatures used may not be adequate. Realising this, it is easily seen why a large percentage of blown cans may result even when the heat treatment given has normally yielded a satisfactory pack. It may be that some steps in the canning operations have been neglected, or the raw material may have been allowed to lie about too long before it was canned, or some of the produce may have been over-ripe with some of the juice exuding in which the organisms could rapidly multiply. There would thus be an undue strain put on the processing and the set time and temperature might not be sufficient to insure sterilisation.

Infection of raw material—It thus behoves the canner to keep down infection of the raw material to a minimum. This may be done by having the fruit delivered at the factory as soon as possible after picking, and in as dry a condition as possible. Careless handling of chip baskets may bruise or crush the fruit making it easier for the micro-organisms to multiply. Delay between filling the cans and sealing them, or a delay in sterilising the cans after they have been sealed tends to increase the number of micro-organisms. Spoiled cans containing produce should at once be removed to a distant place as the very same organisms which have caused spoilage already, having survived the heating process, may prove a source of infection. Another important source of infection is a dirty apparatus. Thus it is a sound scheme to have a thorough clean up after each day's run. Another very likely source of contamination is a wooden tank which gets impregnated with micro-organisms. Diseased fruits and vegetables should be removed and either burnt or buried.

It is a well known fact amongst canners that some fruits are more easily sterilized than others and that fruit as a whole requires far less heat than vegetables. This is largely due to the difference in chemical composition. Fruits invariably contain organic acids and these assist the heat to such an extent in processing that it is not necessary to heat the cans to a higher temperature than that of boiling water. In sterilising fruits which are very low in acid, more reliable results can be obtained by adding a litlle tartaric acid to the syrup.

Automatic cookers and coolers :—In modern factories automatic cookers are now used. These are known as continuous variable discharge cookers. In this type of machine the heat penetration is remarkably uniform and the contents of the cans quickly reach an effective cooking temperature. With these machines it has been

found that most products can be safely processed very much quicker than is possible with the open tank method, and a more uniform product can be obtained. The length of cook is not determined by regulating the speed at which the machine is driven as this always remains the same but by opening one of the small doors which are placed along the side of the cooker. When a product is being processed which only requires a short cook, the first or second door is opened, and the cans discharge there, whereas for longer cook one of the doors further along is opened. Each door corresponds to a definite time, and cans of fruit therefore can be cooked for from 5-20 minutes or longer if necessary.

After cooking, the cans pass through a similar machine to the above, but this time they revolve through cold water to cool them rapidly. Quick cooling plays an important part in the appearance of the product. It prevents over-cooking of the fruit and thus tends to keep the fruit whole, whilst it also helps somewhat in keeping the colour of the product.

Jams Jellies And Marmalades From Punjab Fruits*

By

Lal Singh, B.Sc. **(Hons),** M.Sc. (Calif.)
Fruit Specialist, Punjab, Lyallpur

and

Girdhari Lal, Ph.D. (Lond.), D.I.C.
Assistant Fruit Biochemist, Lyallpur

India imports jams and jellies worth about six to seven lakhs of rupees annually. In addition to this, fairly large quantities of local products (home-made or commercial) are consumed. Demand for such products can still further be increased if the available resources of the country, viz. cheap fruit (third-grade cull fruit unfit for table purposes), cheap labour, etc. are utilized. These potentialities, coupled with an up-to-date knowledge (seriously lacking at present) in the technique of all aspects of fruits and vegetable preservation could give a great impetus to this industry. Admittedly, therefore, at this stage, the technical side of this subject requires attention.

It is gratifying to note that the systematic work on the standardization of different kinds of fruit and vegetable products, which has been in progress in the Punjab since 1934, has contributed a good deal towards the solution of this problem. Observations recorded in the preparation of jams, jellies and marmalades from some Punjab fruits (pears, plums, guavas, citrus fruits like oranges, *sangtras*, etc.) from a part of the work in hand.

What is a good jelly or marmalade ?—A perfect fruit jelly should be sparkling. transparent and attractive in colour, and should have a strong flavour of the original

*Reprinted from 'Indian Farming' April, 1941.

fruit. It should not be gummy, sticky or syrupy and when cut with a knife it should have a sharp edge, and a clear cut surface. A jelly may be thick-set or soft-set. Any of the above types of jellies in which pieces of fruits are suspended is called a marmalade. The term marmalade, in this country, is usually associated with a product made from fruits like oranges and lemons. In this case, the suspension in the jelly is the shredded peels of these fruits.

Jelly-making consists of boiling a clear fruit juice extract with an adequate quantity of sugar to such a stage that when allowed to cool, it will form a jelly.

These principles, as given below, also apply to the making of marmalade.

Fruit jellies are made from fruit juices which consist chiefly of water in which are dissolved small amounts of naturally occurring substances like sugars, acids, pectins, proteins, flavouring material, etc. Sugar must always be added as its natural occurrence is not sufficient to make a jelly. Some fruit juices are deficient in either pectin or acid, or in both, and in such cases, a correct balance of these for jelly making has to be obtained by adding one or both of these ingredients in definite proportions to obtain a good fruit jelly.

Occurrence of pectin in fruits · Pectin, as mentioned above, occurs naturally in practically all fruits. Its quantity, however, varies with different kinds and even with different varieties of the same fruit. The largest amount of pectin occurs when a fruit has attained its full size and is reaching maturity—a stage just preceding the eating ripe stage. This type of fruit should be used for jelly-making. Pectin content of fruits also increases during dry seasons and is less during moist weather.

By boiling the fruit in adequate quantity of water, the pectin comes out from the fruit tissues in which it is held. All the above factors should be carefully considered before selecting fruit for jelly-making.

Fruits deficient in acid, as a rule, do not make good jellies. In such cases a little lemon or lime (*kaghzi-nimboo*) juice, citric acid or tartaric acid must be added. Sufficient acid, in either of the above forms, should be added to give the juice a sourness roughly the same as in sour apples. Addition of one to two pounds of lemon or lime juice, or one to two ounces of citric or tartaric acid (preferably citric acid) per 100 lb. of juice extract (low acidity) will give the desired acidity.

Method of jelly-making - All firm fruits should be cut into thin slices, covered with water, and boiled in covered kettles or saucepans preferably of aluminium. For home production cooking may be done on open fire, but for semi-commercial or commercial production double-jacketed steam kettles should be used. These kettles are available in varying sizes and are made of copper, aluminium, monel* metal or stainless steel (for jams and jellies copper should be avoided). Inside the double jacket, a coiled steam pipe is fitted, one end of which is attached to the steam feed (40-80 lb. pressure) and the other is fitted with a safety valve to permit steam escape in case of excessive pressure. These kettles ensure regular heating and avoid cooked or burnt flavours in the product.

The fruit should be boiled just enough to soften it. When the fruit becomes soft enough, the whole mass is placed in a jelly bag or double layer of cheese cloth or any other suitable thick cloth and the clear extract allowed to drip. The juice must on no account be forced out by pressing. The first extract always gives a product of good quality, but the general practice is to add more water to the residue and boil for a short period to extract more pectin. This may be mixed with the first extract.

Addition of sugar —To avoid scum-forming during cooking (see below) which, unless removed, impairs the clarity of the jelly, only the best quality crystalline sugar

* A non-corrodible alloy of nickel, copper, manganese, etc.

should be used. Too much sugar is liable to produce a syrupy jelly and may even result in crystallization ; on the other hand, an insufficient quantity of sugar sometimes gives a tough jelly. The amount of sugar required to make a good jelly depends upon the quantity of pectin and acid present in the juice, the former being more important.

To ascertain the quantity of pectin present in the juice extract, two tests are generally employed.

Alcohol test – Take a tea-spoonful of cooled juice in a small glass tumbler or a beaker and add to it two tea-spoonfuls of methylated spirit, shake gently and allow it to stand for a while. Pour out the mixture on to a plate and note the size of clots it drops in. These clots (Fig. I) indicate the amount of pectin present.

(i) A number of small clots (Plate 44, Fig. 1 A) indicate pectin present in small quantities and sugar added should be half a cup or a pound for every cup or pound of juice extract. It is however, advisable in some cases, to concentrate the juice to increase the pectin content.

(ii) When two or three clots (Plate 44, Fig. 1 B) are formed, ¾ cup or ¾ lb. sugar should be added for every cup or pound of juice extract.

(iii) If only one large clot is formed (Plate 44, Fig. 1 C)' it indicates that the juice is rich in pectin and an equal measure of weight of sugar should be added.

Jelmeter test -- The jelmeter (Plate 44, Fig. 2) recently invented by Prof. Baker of Delaware University (U. S. A.) is a very handy and simple device (costing about Rs. 9) and is now commonly used for determining the right amount of sugar for making jams and jellies. The test applied by this instrument is more accurate than the alcohol method. The method of using this instrument is briefly described below.

Hold the jelmeter in upright position (Plate 44, Fig. 2) in the hand, closing the narrow end with the little finger. Pour the cooled juice extract into the jelmeter through its wider end and fill it to the top (brimful). Remove finger from the botton and let the extract flow or drip exactly for one minute replace the finger and note the nearest graduation mark on the jelmeter where the level of the juice stands. This reading shows the cup or pound of sugar to be added for each cup or pound of juice extract.

For jams, 4 oz. of sugar are added in excess to the jelmeter reading for every pound of juice extract.

In case the juice extract is very rich in pectin and the level, after the test, does not go below the uppermost mark of the jelmeter, the juice extract may be diluted slightly. If, however, the extract is very poor in pectin and flows below the bottom mark, it should either be concentrated by further boiling, or powdered or liquid pectin should be added to get a suitable reading on the jelmeter.

Cooking or boiling—Put the strained juice in an open pan preferably of aluminium (for large-scale production use steam-jacketed kettles) and add the requisite amount of sugar (as determined by the above test) and heat the mixture to boiling point. Strain it hot through a double layer of thick cloth, or preferably a felt bag, to remove sugar impurities. Replace and boil again, removing any scum that may appear. Cook until any of the following tests are obtained.

Sheeting test.—Take up a little of the boiling mixture in a ladle, allow it to cool a little and let it drip (Plate 44, Fig. 3). If the jelly flows down in thick drops (Plate 44, Fig. 3A), more cooking is required, but if it drops in flakes (Plate 44, Fig. 3B) the jelly has reached the final stage.

Drop test.—A drop of the boiling mixture is placed on a cold china plate from time to time and the condition of the drop by experience indicates the finishing point. This test is not so rapid and accurate as the above test.

Temperature control test—If correct proportions of sugar, acid and pectin are used, then a proper jelly will be formed when the mixture reads 222°F. at sea-level, i.e. further cooking should cease when the above temperature is reached. This temperature, i.e. 222°F., may be decreased by 1° for every 500 ft. rise in the altitude from the sea-level of the place where the jelly is prepared. For instance, at an elevation of 2,000 ft. about sea-level, the cooking should cease when the temperature of 218°F. is reached.

For home production, an ordinary but accurate Fahrenheit thermometer can be used, but for large-scale production where boiling is done in steam-jacketed kettles, a special jelly thermometer (Plate 44, Fig. 4) should be used on this. The operator can read the temperature while standing at a distance from the boiling pan.

Weight method—In the case of jellies, after making the jelmeter test, as directed above, weigh the juice extract and add sugar as shown in Table I; cook until the weight indicated for jellies in Table I is obtained.

Table I

Cooking weight of jams and jellies

Jelmeter test figures on nearest line	Sugar to add for each lb. of juice extract				Cook to weight			
	Jellies		Jams		Jellies		Jams	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
1¼ ...	1	4	1	8	2	0	2	6
1 ...	1	0	1	4	1	10	2	0
¾ ...	0	12	1	0	1	4	1	10
½ ...	0	8	0	12	0	14	1	4

Directions for cooking jams are the same as for jellies but the amount of sugar to add is increased. In this case, cook to weight as shown for jams in Table I.

The weight method is generally used for home-scale production when a jam or jelly is cooked in a kettle or

pan placed on direct fire. The kettle or pan is weighed by means of a spring balance or any other convenient scale; known weight of juice extract and sugar are put and cooking is stopped when the weight (which can be calculated from Table I in accordance with the quantity handled) indicated for jams and jellies in Table I is obtained.

Filling and sealing—For production on home scale, pour the jelly or marmalade, while hot, into dry sterilized jars (previously heated in boiling water for about half an hour) or in dry tin cans previously rinsed with hot water. Allow the contents to cool overnight, keeping them covered with a piece of clean paper or cloth. When cool, a thin layer of hot melting paraffin wax or a piece of butter paper dipped in alcohol or brandy may be put over the surface of the contents after which the containers are sealed. The lids of the jars are fixed in position and lids of the cans are sealed with a can sealer, and the product is stored in a cool dry place. For production on a commercial scale, pour the jelly scalding hot in jars or tins and seal airtight immediately. If jellies made from red-coloured fruits are filled in tin cans, the inside of the can should be heavily lacquered to prevent bleacing of colour.

Jam-making—Ordinarily, fruits unfit for fresh market or canning, such as those damaged by hailstorms, blemished or slightly over-ripe or under-ripe, etc. are used for jam-making.

Soft fruits like berries may be washed. Stone fruits can be made into jam with or without stones. Hard fruits should be softened by boiling.

Consistency of jam may or may not be jelly-like, but it is always desirable to have jam which sets like a jelly and in such cases a small amount of juice of the fruit used is extracted and the pectin test applied to that juice.

To determine the final consistency in a jam, it is not possible to apply the sheeting test, and therefore the

temperature control method or the weight method should be applied. For home production jam may be filled in containers and sealed in the manner as described for jellies. In commercial practice, however, the product is poured, while hot, into jars or cans and immediately sealed. The filled jars or cans are then placed in an inverted position for 5-10 minutes, so that the hot jam comes into contact with the inside of the cover and sterilizes it. The containers, when quite cold, are stored in a cool, dry place.

Recipes—The product prepared from the recipes given below has been tested during two years' storage and found to be excellent.

Citrus marmalades—Marmalade comparing very favourably with any of the imported brands can be made from the following fruits with the following combinations :

(*a*) Malta orange and *khatta* (*Citrus aurantium*) 2 : 1 by weight. (Peel shreds of *Malta* oranges.)

(*b*) *Sangtra* and *khatta* 2 : 1 by weight. (Peel shreds of *sangtra* oranges.)

(*c*) *Khatta* alone. (Peel shreds of Malta oranges.)

The product is likely to become dark in about 6 months' srorage.

(*d*) Malta orange and *galgal* (*Citrus limonia*) 2 : 1 by weight. (Peel shreds of Malta oranges.)

Wash fruit, and with a sharp knife remove only the upper yellow portion of the skin (except *sangtras* which can be peeled by hand), leaving as much of the white portion of the peel on the fruit as possible (for making peel shreds see below). Cut the fruit into thin slices, add water just enough to cover the sliced fruit and boil for about an hour to extract pectin. Follow the directions as given for jellies, viz. strain the juice, add correct amount of sugar (it is advisable to boil the juice and strain once again before adding sugar), cook, add peel shreds which should be prepared beforehand and boil until jelly with peel suspensions is ready.

To prevent darkening of marmalade in storage, allow it to cool a little, and add potassium meta-bisulphite dissolved in a small amount of water at the rate of 4 gm. (about one drachm) per 100 lb. of the finished product. This should not be done if the marmalade is to be filled in cans.

Cut the peels of the fruit into thin or thick slices as desired, about 1 to 1½ in. long, with a sharp knife or a handworked slicing machine (for commercial production power-driven slicers can be used). To remove bitterness of the peel, boil these shreds in water for 10-15 minutes, discard the water extract and boil again in water for 5-10 minutes. Add the shreds at the rate of one ounce to one pound of original juice extract, to the boiling jelly, when a temperature of 218°F. (at sea-level) is reached. Unless added in the above manner, the shreds may not remain evenly suspended in the finished marmalade. After the marmalade is poured in the glass jar or tin, it may be desirable to stir the contents with a glass rod or spoon to spread evenly the shreds in the whole mass.

Guava jelly—For this product fresh, slightly under-ripe fruit, is the best. Wash fruit, discard damaged portions, cut into slices, add an equal quantity of water and ¾ fluid oz. of lemon juice, per lb. of fruit. Boil for half an hour (instead of lemon juice, about ½ to 1 fluid drachm of citric acid solution prepared by dissolving one pound of citric acid in one pint of water can also be used). For the rest of the process, see general directions for jelly-making.

The above method can also be used for the preparation of apple and plum jelly. For plum jelly, however, pits are discarded. The quantities of lemon juice or citric acid solution can be varied according to the tartness or otherwise of the fruit. In case apples and plums are already tart enough, acid did not be added.

Pear jam—Wash fruit, discard damaged parts, removed peels and cores. While peeling keep the peeled

and cored fruit in 1 to 2 per cent brine (common salt solution) to avoid browning. Cut the prepared fruit into thin slices, add sugar at $\frac{3}{4}$ lb. to one lb. of fruit and cook as for jams. Wen near the final stage, add 2 to $3\frac{3}{4}$ oz. citric acid dissolved in a small amount of water for every 100 lb. of the fruit pulp and thoroughly mix. Fill the jam in jars or cans as directed above.

Plum jam—(with or without stones). Red plums are the best. Wash fruit, discard rotten or damaged fruits, wash and remove pits if a stoneless product is required, add $\frac{1}{2}$ lb. water and $\frac{3}{4}$ fluid oz. of lemon juice per lb. of fruit and boil for 15 min. For the rest of the process, see directions for jam-making.

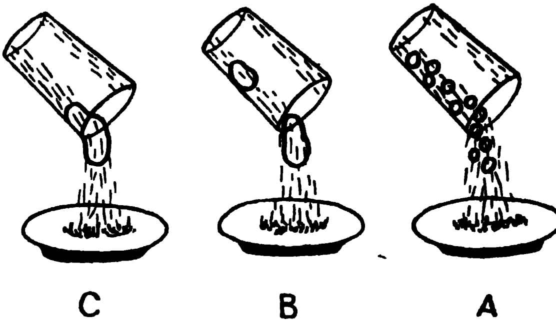
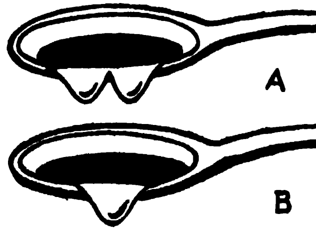


Fig. 1. Alcohol test for pectin



Eig, 3. Sheeting test

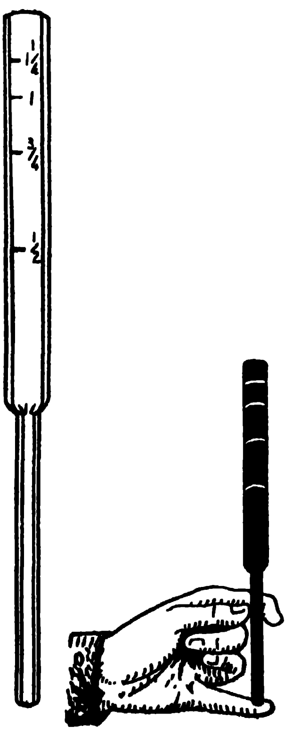


Fig. 2.
The jelmeter, recently invented by Prof. Baker, is now commonly used for determining the right amount of sugar for making jams and jellies.



Fig. 4.
For large scale production a special Jelly Thermometer should be used, The operator can read the temperature while standing at a distance.

Fruit Preservation Industry in Bengal

By

D. K. Dutt.

It was Nepolean Bonaparte who first realised that rations were as much necessary as ammunitions to enable the army to fight in the actual field of battle. The army food should be such as could be easily served without waste of time and should not deteriorate if stored for a reasonable length of time. The French-Government, accordingly, offered a handsome prize for the invention of a method by which food could, easily, be transported from place to place without being spoilt. This was won by one Nicholas Appert, from whom the world has learnt the science of food preservation. Homage, should, also be paid to another eminent French scientist Louis Pasteur whose many scientific investigations have considerably irradiated on the Food Preserving Industry.

The seeds of the fruit and vegetable preserving industry in Bengal were sown over a century ago. In the days of the East India Company "ACHARS AND MORABBAS" appealed so much to the Europeans that when they returned to their homes, they carried with them some quantities of these novel Indian Table delicasies for their kith and kin. This stimulated the growth of a few manufacturing houses notable amongst whom were :—

1. Nujeeb Khan & Co.
2. Nanna Khan & Co.
3. Harry & Co.
4. H. D. Manna & Co.
5. Sree Kissen Dutt & Co.

and 6. The Great Eastern Hotel Condiment Factory.

Unfortunately, the first four dwindled away in course of time while the latter two after weathering many a storm

are still in existence although the ownership of the last named has, since, changed hands. Subsequent manufacturers are :—

1. Mitter Sircar & Co.
2. Atwool Dodd & Co.
3. Bengal Canning & Condiment Works Ltd.
4. Farm & Fruit Products Ltd.
5. Daw Sen & Co.
6. Boral & Sen.
7. Great Eastern Preserving Works.
8. Farmer's Preserve Works Ltd.
9. Ideal Preserving Co,
10. Pickola Co.
11. Mida & Co.

and others.

The development of this industry in Bengal owes much to the efforts of the late S. N. Dutt of Sreekissen Dutt & Co. and Mr. B. Sinha of Bengal Preserving Co. of Muzzaffurpur, who did a good deal of pioneering work. With the progress of time and development of Science, some of the firms have equipped themselves with modern steam cooking and other canning machineries and appliances.

Some how or other an idea prevails among the general public that Bengal lags far behind other Provinces in the manufacture of fruit and vegetable products. But a look at the Foreign trade statistics and the rail-borne traffic of India will show otherwise. The supplies made to the Military Department of the Government of India during the last Great War and the present war as well will also speak that Bengal manufacturers are not lagging behind their compeers in other Provinces of India.

The drawbacks to further progress in this industry have been outlined in the I. E. A. R. Report, besides the excessive Railway freight, there is a lack of cold storage over land transport, trained hands in the line as also the

non-availability of suitable containers both glass jars and tins of desired quality at reasonable prices in India.

It is hoped that this Exhibition will serve as a pointer towards further research work where needed and to a development of the fruit and vegetable growing and preserving industries in India.

A Note on the Fruit Preservation Industry in the United Provinces

By

John A. Manwar,

Provincial Marketing Officer, United Provinces.

The Fruit Preservation Industry in the United Provinces is of recent origin. The Department of Agriculture has been entrusted with its development in these provinces. To give an encouragement to the public, the Government installed a demonstration jam factory at Government Gardens Chaubattia in the year 1924. The factory produced jams of high quality but unfortunately, it could not compete in the local market and hence had to be closed down a few years later. A number of small jam makers also sprang up in Dehra Dun and Mussoorie and did good business. During the slump period that followed the year 1931, the jam makers were badly hit and suffered heavy losses.

The Fruit Industry in general received a good deal of attention during the period when Mr. R. G. Allan, C.I.E., I.A.S., was the Director of Agriculture, U. P. He laid the foundation of the U. P. Fruit Development Board which was entrusted with the advancement of the fruit industry in co-operation with the Department of Agriculture. A good deal of propaganda was done through his efforts to develop the fruit industry and to encourage fruit growing and marketting through district Associations and Fruit Preservation. The Government readily responded to the general interest taken in this industry at this time by creating the post of Fruit Expert to Government, United Provinces, in the U. P. Agricultural Service Class I. An officer of the Bombay Agricultural Department, was appointed to this post in the year 1935, and he was held

mainly responsible for the development of the Fruit Preservation Industry in these provinces. Unfortunately, however, this officer did not continue long and the Government found it necessary to abolish this post and create instead a new post of Fruit Utilization Officer in the U. P. Agricultural Service Class II under the Provincial Marketing Officer, United Provinces, Lucknow. This officer was appointed in the year 1939 and was entrusted with the work of development of the Fruit Preservation Industry by imparting training on the subject to interested persons and by encouraging capitalists to start factories on commercial scale.

On the recommendation of the Sapru Committee on unemployment, the Government granted scholarships to ten students to undergo training in Fruit Preservation and Canning for a period of six months at the Fruit Preservation Institute of the Allahabad Fruit Grower's Association. After the completion of their training, each candidate was given a grant-in-aid of Rs. 700/- for the purchase of apparatus and equipment. At the outset, these students started their work with great enthusiasm but, after some time, one after the other closed his business and took up employment. Only two of these viz. the Narain Horticultural Gardens, Ajitmal, Etawah and Mr. Hoti Lal Sharma of Kasganj are still doing their business.

A scheme for conducting short term classes in Fruit Preservation & Canning at different centres in the province was sanctioned by the Government in the year 1939 at a total cost of Rs. 5,000/-. The recurring cost of this scheme is Rs. 2,000/- per year. Classes have been held at Lucknow, Cawnpore, Benares, Gorakhpur, Agra, Meerut, Dehra Dun, Nainital and Fyzabad. The Classes are open to both sexes and are intended to provide a preliminary training on Fruit Preservation to those who are desirous of starting it on a cottage scale or for domestic purposes only. Practical demonstrations are given

to the students and they are given every opportunity of preparing fruit products with their own hands. 287 candidates have so far been trained. A certificate is awarded to successful candidates at the end of the course. A few students who had received training in this classes have since established themselves in their own business at Agra, Lucknow and Meerut. It is a pleasure to find them doing well and earning a decent living out of it.

For want of a research laboratory, not much could be done on the research side. The Government were approached to sanction the establishment of a laboratory, but for want of funds, the proposal was dropped. Great difficulty is being felt in attending to technical problems received from fruit preservation factories. It is absolutely essential to have a laboratory where problems of the trade could be solved. For want of it, not much progress has been made in the province on commercial canning. A few firm have, however, sprung up in these provinces in recent years. The names of important firms are given below together with the products they are manufacturing.

1. The G. G. Fruit Preserving Factory, Agra, (started 1938) Canning mangoes, peaches and petha.
   Preparing Jams, tomato sauce, chutneys and squashes etc.
2. The Hindusthan Products Ltd., Moradabad. (started 1940) Canning Peaches, Pears and Apricots, Tomatoes. Preparing Jams and Chutneys.
3. N. R. Dean & Sons, Sudder Bazar, Agra, (started, 1940). Jams, Jellies, Chutneys, Squashes, Crystallised Fruits etc.
4. Araura Fruit Industry, Charbagh, Lucknow (started 1940). Morrabbas, Chutneys, Achars, Tomato Sauce and Syrups.
5. The Narain Horticultural Gardens, Ajitmal, Etawah (started 1939) Canning Mangoes, Tomato Sauce and Squashes.

6. S. Wasi Uddin & Sons, General Merchants, Meerut. (started 1940).
7. Secretary, Allahabad Fruit Growers Association, Allahabad, (started 1937).
8. Daurala Sugar Works, Daurala, District Meerut. (started 1939).
9. Allen Orchard Estates, P. O. Ramgarh, District, Meerut (started 1939).

The Province is consuming a very large quantity of fruit products every year. A survey of the local consumption of fruit products including canned fruits, jams and jellies and squashes etc. has revealed that the Lucknow market consumes fruit products worth about half a lakh of Rupees every year. There are a number of big cities and military cantonments in these provinces and these centres consume a fairly large amount of preserved fruit products every year. The demand seems to be on the increase and during times such as these, when it is difficult to import fruit products from other countries, the products manufactured in these provinces are finding a good response from the market. It is however, necessary to manufacture products of standard quality and to make the packing attractive in order to capture the market. This can only be done when the principles of AGMARK are applied to all kinds of fruit products so that the consumers may be able to obtain a standard quality of products. Opening of a Regional Research Station in Fruit Preservation and Canning is under the consideration of the Government. This will enable the Fruit Utilization Officer to undertake research on problems affecting the local fruit preservation industry and thus improve the general quality of products put on the market for sale.

Some Suggestive Recipes.

1. JAMS.

(1) Apricot Jam

4 lb. fresh apricots   4 lb. sugar   ¾ pint water

Wash the fruit, cut in halves and remove the stones. Put the apricots into a preserving pan with the water. Remove the kernels from some of the stones blanch by dipping in boiling water and add the halved white kernels to the fruit. Simmer until tender, and the contents of the pan are reduced considerably. Add the sugar, stir, until dissolved, bring to boiling point and boil hard for 15 minutes or until setting point is reached.

Weight to which fruit and water should be reduced before addition of sugar ... 4lb. + 1 oz. + weight of pan.

Weight of jam when finished 6 lb. 11 oz + weight of pan.

(2) Blackcurrant Jam.

4 lb. blackcurrants   6 lb. sugar   3 pints water.

Remove the stalks, wash the fruit if necessary, and put into a preserving pan with the water. Simmer gently until the fruit is quite tender and the contents of the pan are reduced considerably. As the pulp becomes thick stir frequently to prevent burning. Add the sugar, stir until it has all dissolved, bring to boiling point and boil hard for 10 minutes, or until setting point is reached.

Weight to which fruit and water should be reduced before addition of sugar ... 4 ½ lb. + weight of pan.

Weight of jam when finished 10 lb. + weight of pan.

(3) Strawberry Jam.

It has been pointed out that the pectin occurs in the cell walls of the fruit, and that the fruit has to be broken down to a certain extent before the pectin can be brought

into solution The most popular strawberry jam, however, is that in which the berries remain whole. For this variety, therefore, it is necessary to add pectin in sufficient quantity to give the desired set. Strawberries are also low in acid, and it is necessary to increase the acidity. This deficiency in pectin and acid can be remedied by adding gooseberry juice or red currant juice, since both these juices are rich in pectin and acid. If neither of these juices is available, a small quantity of fruit pectin and lemon juice or tartaric acid may be used.

Recipe 1.

4 lb. hulled strawberries 3½ lb. sugar.
The juice of 4 lemons.

Remove the stalks and hulls. Put the fruits into the preserving pan with the lemon juice and simmer slowly until the berries are somewhat broken up and plently of juice has been extracted (about 20-30 minutes). Add the sugar, stir until it is dissolved, and boil rapidly for 10-15 minutes or until setting point is reached. Remove scum at once and allow to cool until a skin forms on the surface of the jam ; stir and pour into pots.

2. JELLIES.

(1) Gooseberry

The fruit should be washed, weighed and placed without snibbing, in a preserving pan, the fruit bring barely covered with cold water, simmered until tender, then mashed well, strained through a scalded jelly bag, and left overnight to drain. The pulp should be removed from the jelly bag, sufficient water added to make a thin mash, simmered again for about ¾ of an hour, strained as before, and the first and second extracts mixed together. (The reason for boiling the extract a second time is to increase the extract and make a more economical preserve.) The juice should be measured, and 1 lb. of sugar allowed to each pint of juice. The sugar should be dissolved in the juice, [illegible] boiled rapidly until it will set when tested

by any of the methods recommended in the previous pages. The jelly should then be skimmed and filled into warmed glasses.

(2) Raspberry or Loganberry

8 lb. loganberries	8 lb. raspberries	2 pints water
1 lb. sugar per pint juice	1 lb. sugar per pint juice.	

The fruit should be placed in the preserving pan, and if loganberries are being used the water should be added. The mixture should be heated gently until it is quite tender, then mashed well, turned into a scalded jelly bag and left over-night to drain. The extracted juice should then be measured, and 1 lb. of sugar allowed to each pint of juice, which should be brought to boiling point before the addition of the sugar. The sugar should be dissolved in the juice, stirred constantly, the whole brought to boiling point and then boiled without being stirred until the jelly is ready. This should be skimmed and poured at once into warmed glasses.

3. MARMALADES.

(1) Serville Orange

When marmalade is made in the home, it is difficult for the inexperienced to know when the preserve is sufficiently boiled to secure a set when it is cool. This difficulty can be overcome by the use of a balance, and the weighing of the marmalade at intervals during the process of cooking.

6 lb. oranges	1 oz. tartaric acid, or the juice of 6 large lemons.
14 pints water	11 lb. sugar.

Scald the oranges, remove the skins and cut these into fine shreds. Weigh out 12 oz. of this peel and tie it in a muslin bag. Cut the croes of the oranges into small pieces, and put them with the remaining peel and the tartaric acid into a basin. Cover with water, add the bag of peel, and soak overnight. Next day simmer for

3 hours, or until rather less than half the contents of the pan have boiled away, but remove the bag of peel after 1½ hours' cooking, so that the peel may not become too soft. Strain the contents of the preserving pan through a jelly bag ; remove the peel from the bag, very thoroughly rinse it in cold water and drain in a colander to free it from fragments which, if allowed to remain, would cause the marmalade to be cloudy in appearance. Weigh the preserving pan, add the strained extract and the rinsed peel, allow the mixture to simmer for 5 to 10 minutes. Then add the sugar, stir untill it is dissolved, and boil rapidly until the weight of the jelly in the pan is 18¼ lb. Skim at once, allow the marmalade to cool slightly, and pour it into warm jars. Cover with wax circle whilst the preserve is still hot, and tie down when cold. It is perhaps necessary to emphasize that the weight of the preserving pan must be added to the weights given in the recipe, and that the spoon should be removed before the weights are taken. A spring balance provided with a hook and suspended near the fire will be found very convenient for the necessary weighings.

The above receip gives a mamrlade of a clear jellied consistency and containing a fair amount of shredded peel.

(2) Lemon

6 large lemons — 6 pints water

Wash the lemons well. Pare off the yellow rind, removing as little of the white pith as possible. Cut the rind into shreds Take off the white pith, cut it into small pieces, or pass through a mincing machine, and tie the pith with the pips in a piece of muslin, and put it in the pan along with the peeled lemons, which would be cut up into small pieces. Add the water and boil until the contents of the pan are considerably reduced and thick. Remove the muslin, squeezing as tightly as possible. Weigh the contents of the pan and add an equal weight of sugar. Bring to boiling point, boil

from 10 to 20 minutes, test for jelling, cool slightly, and pour into pots, cover with wax circles and tie down hot or cold.

4. PICKLES

(1) Cauliflower

Sound cauliflower should be selected and the outer leaves removed. The flowers should be broken into small pieces, washed thoroughly in salt and water placed in a large basin, and covered with brine made from 1 lb. salt to 1 gall. of water, and allowed to stand for 24 hours. They should then be rinsed in cold water, drained thoroughly, and placed in bottles or jars. The spiced vinegar should be poured over, and the bottles sealed with corks or tied down with a piece of bladder.

(2) Onions

Small, even sized onions should be selected and placed with their skins on in a brine made from 1 lb. salt to 1 gall. water. They should be left for 12 hours, and then peeled, laid in a fresh brine, and left for 24-36 hours. They should then be removed from the brine, washed thoroughly in cold water, and allowed to drain thoroughly. The onions should then be filled into jars or bottles, covered with cold spiced vinegar, and kept for three or four months before being used.

(3) Green Tomatoes

5 lb. green tomatoes	1 lb. Demerara sugar
1 lb. small onions	1 quart spiced vinegar.

The tomatoes and onions should be sliced, sprinkled with salt, left overnight, drained thoroughly. The sugar and vinegar should be boiled, the tomatoes and onions added and cooked until tender. They should then be put into jars and sealed.

5. PRESERVATION OF VEGETABLES

(1) Young Carrots

These should be preserved in late June and early July when they are only about 3 in. in length.

(1) The tops should be removed and the carrots thoroughly washed to remove all traces of soil.

(2) They should be placed in a saucepan of boiling water and boiled from 10 to 15 minutes. For very young carrots 10 minutes' boiling is quite long enough.

(3) The carrots should be removed from the boiling water and placed at once in cold water.

(4) The skins should be removed with a clean cloth, care being taken not to break the pointed end of the carrot. Any black parts should be cut away and the carrots trimmed where necessary.

(5) As soon as they have been skinned they should be laid in cold water to preserve the bright colour and to keep them fresh.

(6) The carrots should be graded for size and each size packed in to the bottles to within ¼ in. of the top.

(7) They should be covered with brine (2-4 oz. salt to 1 gall. water) and sterilized in a pressure cooker at 10 lb. pressure for 35 minutes.

(2) Peas

(1) The peas should be shelled, thoroughly washed, and tied loosely in muslin.

(2) The bag of peas should dipped in boiling water for 2 minutes.

(3) When removed from the boiling water, the bag should be placed in a basin of cold water for a few minutes.

(4) The peas should be packed into clean vacuum bottles to within ¼ in. of the top. They should not be packed too tightly.

(5) The peas •should then be covered completely with brine made from 2 oz. of salt, 4 oz. of sugar and 1 gall. of water.

(6) The bottle should be sterilized in a pressure cooker at 10 lb, pressure for 35 minutes.

To Use Bottled Peas—The bottle should be opened, care being taken not to chip the glass. The peas should be placed in a net or muslin bag and boiled for 10 to 15 minutes ; in this way they may be heated without becoming broken.

6. DEHYDRATION OF VEGETABLES

The process of dehydration, or drying, of vegetables for preservation and use much after the season, is not a new one and has been practised in India for centuries—especially with turnips and post-herbs in Kashmir where the cold is so intense for part of the year that people store in sufficient stocks of everything to tide over the Cold weather.

It came to a good use when during the last Great War troops were supplied with thousands of tons of dehydrated Irish potatoes, turnips, carrots, onions and other vegetables.

With a view to getting palatable products, some important points have to be observed, namly.

(1) All fruits and vegetables meant for drying should be of good quality, free from disease, sun-scald, frosting or other injury.

(2) They should be thoroughly washed and all dirt removed and vegetables peeled and washed again.

(3) Drying should be so done that the vegetables do not loose their colour or flavour.

(4) After drying, they should be packed in air-tight containers and protected against insects, moisture.

(5) Cleanliness is important at every stage.

Methods

Drying may be done in one of the four mothods e.g. (1) Sun-drying, (2) Steaming, (3) Boiling water and (4) 'Sulphuring'.

Before undertaking any of the above methods, vegetables, potatoes for example, should be selected of uniform size and maturity. They should be washed, sliced into quarter-inch thick slices and placed in cool water or 2% saline solution (brine).

(1) Sun-drying the oldest, crudest and the cheapest method. It is still practised in most parts of India.

(2) Steaming. Sliced potatoes are placed in perforated trays and a current of steam passed over them for 7 minutes.

(3) Boiling water. Sliced potatoes are dipped in boiling water for 2 minutes.

(4) Sulphuring consist of treatment with SO_2 gas generated by burning rock sulpher under baskets in an airtight oven.

After the above operation, potatoes should be dried in temperature rising upto 175°F in a chamber in which the humidity should be between 20 and 40%.

In the case of Sun-drying it may take 3 to 7 days to complete dry the substance. By artificial methods, potatoes and other vegetables may be dried in 2 hours. These methods, however, require a capital out-lay while the natural methods costs practically nothing.

Classification of Fruit-Plants grown in India.

By

Dr. K. Biswas, M.A., D.Sc. (Edin.), F.R.S.E.,

Superintendent, Royal Botanic Garden, Calcutta, Hony. Lecturer in Botany, Post Graduate Department in Science, Calcutta University.

Fruit is the growth development initiated by fertilisation. When the fruit is the product of an ovary only, it is true fruit, and when other parts of a flower are associated in the development of the ovary resulting in a fruit, it is known as false fruit. Such a distinction does not, however, hold good in the detailed classification of fruits. Three main types of fruits are generally distinguished : (1) Simple fruit-in which a single flower gives rise to one indivisible fruit, (2) Aggregate fruit—in which several carpels containing seeds fuse to form a fruit, such as strawberry, Rubus, &c. and (3) Composite, multiple or collective fruit—in which several flowers in an inflorescence combine to develop into one fruit as in fig., pineapple, &c. The fruit may be dry or fleshy and dehiscent or indehiscent. Some break up into more than one or one-seeded portions when they are known as Capsular or Schizocarpic fruits. The dry, indehiscent, one-seeded fruit is again divided into Achenes, Cypsela, Caryopsis, Semara and so on. Among the Achenes the well-known fruits are of the grasses, such as Oat, Maize, Barley, &c., which are technically called Caryopsis. Of the Nuts, the common examples are Coconut, Betelnut and others. Among the simple indehiscent fruits, we get various types where the pericarp or the outer covering camposed of three layers—epicarp, mesocarp and endocarp, of the seed may be fleshy or membranous and thus the fruit may be called a Drupe or Berry (Bactatefruit) or Pome. The

classification of the fruit is also sometimes correlated with the dispersal of the fruits and seeds. Fruits and seeds which are dispersed by means of water are known as Hydrochorous fruits. Those which are dispersed by animals are known as Zoochorús. Those which are dispersed by air are called Anemochorus. In addition to these what may be called "passive" fruits, there are other types of fruits which do not depend for their dispersal on other agents such as water, animal or air, but they are "active" in the sense that these fruits are provided with mechanisms by which the seeds sre dispersed after the breaking of their outer covering. All these fruits are known as Capsuler and Schizocarpic fruits.

The type of classification given here is not with reference to the different types of fruits, but to the different species which are grown in India and yield various edible fruits. In the classification of the species yielding edible fruits the system followed by me is that of Benthem and Hooker's Genera Plantarum (1862-93). This system is adopted in India and other parts of the British Empire. There is another system of classification which is followed in different institutions in Europe, America and other parts of the world. This is the system of Engler as given in his Syllabus der Pflanzenfamilien (latest edition).

Among the various species yielding edible fruits in India there are quite a number of plants which are exotic to this country, but they have been in cultivation for many years. Most of these fruit-plants were introduced about a century and a half ago to the Royal Botanic Garden, Calcutta, where many foreign economic plants were, and still are, first introduced and acclimatised and subsequently distributed to the different parts of India. Some fruits were introduced to India by Portuguese traders in very early period, as for example, *Ananas Sativas* (Anaras) the well-known pine-apple. This fruit-plant is apparently a native of Brazil and was introduced to India by the Portuguese in 1594. *Achras Sapota* yielding Sapota

fruit is also a native of America. Roxburgh mentions in his Flora Indica that it is a native of China, from where it was introduced into the Royal Botanic Garden, Calcutta. Diospyros Kaki which is cultivated in India for its edible fruit is considered by Roxburgh as a native of China and Japan and the mountains of Nepal to the northwest of Bengal. Sir Joseph Dalton Hooker recorded this plant from the Khasia hills. The well-known tomato plant *Solanum lycopersicum (Lycopersicnm esculantum)* was introduced from Tropical & Subtrofical America. Rumphius considered this plant a native of South America which was introduced to India and is now so much cultivated all over the world for its nutritous fruits. There are various other similar foreigh fruit plants which are too many to be dealt with here.

Very little work in India has so far been done regarding the improvement of better types of fruits which are not only better from the standpoint of edibility but also from the standpoint of larger yield, better taste and resisting power against diseases. In such investigation, search for plants belonging to the allied species and genera will have to be made in the unexplored areas of this country with a veiw to finding out suitable species which might respond to crossings and grafting experiments. Intergeneric and Inter-specific crosses should be encouraged among the various fruit-yielding plants in India and her neighbouring parts. It is true as C. F. Baker, whose contributions are so well-known towards the advancement of our knowledge of the science of tropical pomology, rightly states, "A similar remark may be made of most tropical fruits. The methods of seed selection, of breeding, and of vegetative propagation have rarely been brought to bear on any of these things. As for systematic search for the better forms now existing, and the rapid building up of really comprehensive experimental plantations in the tropical Botanic Gardens and Experiment Stations, we have yet a field of highly useful, most remunerative and intensely interesting work before

us." In the classification of the fruit plants mentioned here I have retained the names which are commonly known among the botanists horticulturists and laymen. I have, however. indicated the correct names – correct according to the inter-national rules of botanical nomenclature-in brackets.

Systematic arrangement of the Fruit-plants grown in India

DICOTYLEDONES

Family—*Dilleniaceae*

1. Dillenia indica Linn

The plant is widely distributed in the plains of India particularly in Bengal, Assam, Burma and Malay Peninsula. The fruit known in vernacular as *Chalta* is a spurious fruit which ripens from October to December. The edible parts are fleshy sepals which have an agreeable acid taste and is mainly eaten after cooking. The fruit is also used for medicinal purposes.

Family—*Anonaceae*

2. Anona reticulata Linn

This is the true *custard apple* or *Bullock's heart* known in vernacular as *Nona* or *Ramphal.* The fruit is an aggregate of berries, The plant is naturalised in Bihar, Bengal and elsewhere and was introduced in very early times to India from America. The fruit is not so good as *Ata.* The pulp is sweet and white.

3. Anona squamosa Linn

The fruit of this plant is superior to the fruit of the former. It is known as *sugar apple, Sitaphal* or *Ata.* It is naturalised in Bihar, Bengal and elsewhere. The fruit is more or less like that of *Nona*, but much more delicious than *Nona* to eat. It is also indigenous to Tropical America. The pulp is milk white and tender, and combines an agreeable fragrance with sweetness.

Family—*Guttiferae*

4. Garcinia mangostana Linn

Attempts to grow *mangosteen* which is indigenous to Molucca Islands, were made at the Royal Botanic Garden,

Calcutta, for years. No tree thrives or fruits in the soil of Bengal. The fruit is liked by many· It is widely cultivated in the Malay and South Burma.

Family—*Tiliaceae*

5. Grewia asiatica

Phalsa or *Shukri* tree yields profusely a palatable small round bluish violet fruit which ripens in April and May.

Family—*Geraniaceae* (*Oxalidaceae*)

5. Averrhoa carambola Linn

The *carambola* or *Kamranga* is commonly cultivated in the gardens with *Averrhoa bilimbi* Linn, for its sour fruits eaten as vegetable or fresh when ripe. The fruits come out of the stem like Jack fruits (*Cauliflowers*).

Family—*Rutaceae*

7. Aegle marmelos Cor.

The *Bael* or *Sriphal* is the well known fruit used so much for medicinal purposes. It is found wild as well as cultivated throughout the plains of India and Burma. The tree is considered sacred to the Hindus. The pulp of the fruit is eaten fresh or as pickles or preserves or as laxative refreshing drink (sherbat).

8. Citrus auruntium Linn

The sweet orange might have been wild or naturalised in this country, after entering through China into Hindusthan like many other species. There are various classifications of the varieties and forms of orange. Prof. T. Tanaka of Japan has given the latest classification of the Citrus after examination the fruits in their actual places of cultivation in the different parts of the world. The chief commercial centres for oranges produced in India are Nagpur, Sylhet, Cherapunji (Khasia hills), Sikkim, Nepal, Garhwal, Kumoan, lower regions of the Eastern and Central Himalaya, Delhi, Deccan, Poona, Coorg, Mysore and the Nilgiris.

9. Citrus decumana Linn

The *Shaddock*, *Pomelo* or *Batavi* nebu as it is called was introduced to India and Ceylon by the Dutch Trader from its home in the Malay Archipelago. The edible multicellular hairs of the fruit are large. The fruit ripens during August to January. It is widely cultivated in Bengal, Assam and South India and the best veriety with white or pink pulp and thin skin is the Bombay pomelo. The improved variety of Bombay pomelo, if grown on a commercial scale, can be exported to Europe and America.

10. Citrus medica Linn

There are many varieties and forms of the *Citron*, *lemon* or *Adam's apple* which goes by the common vernacular name *nimbu* or *limbu.* The plant is supposed to be wild in Chittagong, Khasia and Garo Hills and also in Kumaon but it has been cultivated so much that the wild form hardly now exists in nature. The citron is widely cultivated in the plains of India. The common lime of India is the variety *acida*, of which *Kagchi* and *Pati* are the two common forms. There is quite a good trade of the various citruses which need proper sorting for producing improved forms.

11. Feronia elephantum Corr

The fruits of *Kathbael* ripen in June. The edible pulp is sub-acid in taste. The tree is found wild and cultivated in the plains of India and thrives well in slightly drier places.

Family—*Rhamnaceae*

12. Zizyphus jujuba Lamk

This is the *Indian Jujuba* or *Chinese date* known in vernacular as *ber* or *kul.* The fruit is globose, fleshy, or the size of a large cherry. Good varieties are larger and sweeter. The tree is wild in the sub-himalayan tracts of the Punjab and United Provinces and widely cultivated in Bengal, Assam and the Coromandal Coast. The fruit

ripens in February and is eaten fresh, pickled or cooked into a chutney.

13. Zizyphu vulgaris Lamk

This *ber*, *singli* or *litni* is wild in the Punjab but much cultivated in the Punjab, Kashmir and westwards for its oval pulpy plum-like fruits. The dried fruit is known as an article of commerce. The Chinese variety is sweeter and larger and it is imported in this country.

Family—*Ampelideae* (*Vitaceae*)

14. Vitis vinifera Linn

The grapes known in this country as *Angur* are favourite fruits for all people, both fresh and dried as raisins. The grape vine is considered wild in the North-west India although it is also indigenous in the temperate parts of the Mediterranean regions. It is extensively cultivated in Kashmir and other suitable parts of Nothern and Western India. The vineyards of Kashmir and neighbourhood can still be extended enormously and indigenous viticulture in Kanwar developed during the Emperor Akbar's time may be revived into an industry. Mysore and parts of the Nilgiris might also prove to be good centres for vine cultivation. The cultivation of grapes has now been based on highly scientific method and many good races, varieties and forms have been produced which can, with advantage, be crossed with the best Indian varieties. The Emperor Akbar successfully initiated the production of vine in Kashmir and in suitable areas. The vine cultivation and associated industry can be developed profitably.

Family—*Sapindaceae*

15. Nephelium Lit-chi Camb—(Litchi chinensis Sonner)

Litchi was introduced to Bengal from South China towards the latter part of the Eighteenth Century. More than one million dollars' worth Litchis are exported from litchi-yielding provinces in Szechwan, Canton and

other areas. Litchis are grown in many parts of India; but the best varieties come from Muzaffarpur in Bihar. Good varieties of Bengal litchis are by no means inferior. United Provinces are also good centres of litchis. The fruit ripens in May to June and the edible part of the fruit is the fleshy aril covering the seed. The fruits are dried and exported by Chinese. The cultivation of this fruit needs attention for more extensive cultivation of the better varieties.

16. Nephelium longana Camb.

The *ashphal* is allied to *litchi* but unlike *litchi* the fruit is smooth and round of the size of a large cherry. It is a Chinese plant but found also wild in the hilly eastern border lands of Bengal.

Family —*Anacardiaceae*

17. Mangifera indica Linn.

The *mango* or better known in India as *Amra*, or *Am* is the ancient sacred fruit of this country and is rightly called "King of fruits". The fruit is unrivalled in colour, smell and taste. This "Amritapal" is the most important fruit of India and the Turkoman Poet Amir Khusru wrote some time in 1325 in Persian verse "The mango is the pride of the Garden, the choicest fruit of Hindusthan". The mention of mango—"Amra" may be traced to the Vedic period and Alphonse De Caudolle considers that mango fruits have been cultivated by men for 4,000 years. There are differences of opinion regarding the original home of mango tree but sufficient evidence exists to show that mangoes are indigenous to lower Himalayan region extending from Kumaon to Bhutan in the middle and lower hill forests. Others are of opinion that it is native of Malayan region like most of the other species of Mangifera. Attempts to produce improved varieties of mangoes were made from as early a period as 1349 or even earlier. The Moghul Emperor Akbar, who did so much to stimulate the cultivation of fruit trees in the Nothern

India, planted the Lakh bagh in Darbhanga. There are more than hundred varieties of mangoes but the best varieties produced are Mazagon, Alphonse at Bombay and Malda in Bengal. The Bombay and Langra varieties of North India such as of Benares, Saharanpur and Allahabad are also delicious fruits. The green mangoes are cooked as chutneys and the ripe ones are eaten fresh, The juice is dried and made into *amsat.* Various other kinds of preserves and pickles are made of mangoes and there is a considerable trade on this valuable fruit. Although Mangoes are the oldest cultivated fruits of India, our knowledge about the life-history of the plant and the physiology, ecology and geneties of the flowers, the detailed methods of their pollination and fertilisation and the nature of the yield per year or every alternate year is very poor. Researches on such problems for greater yield, production of improved disease-proof varieties by judicial cross breeding and grafting and quicker rotation in the yield are imperative. Export of mangoes to the countries overseas might also be possible by adopting scientific methods of packing and transit by fast planes.

18. Anacardium occidentale Linn.

The *Cashew-nut*, known in vernacular *hijlibadam* was originally introduced to India from South America. It is naturalised in the forests along the coast line of India growing gregariously in rather sandy places. The kidney shaped nut develop on the fleshy peduncle. The kernel of the seed and also the succulent fruit-pedicels are edible. The nut is eaten fresh or roasted. The nuts also yield oil.

19. Pistacia vera Linn.

The kernel of the well-known *pesta* or *pista* is eaten fresh or fried. The tree grows in Afghanistan, Beluchistan and west wards and the fruits are exported to India. Attempts may be made to grow the plant in suitable places in Kashmir and its neighbourhood.

20. Spondias mangifera Willd.

The fruit tree known as *amra* grows wild in the hills of the Coromandal coast. There are two varieties—one Deshi and the other sweeter Bilati amrah. The fruit is eaten either raw or cooked into chutneys. They are also pickled or made into tarts.

Family—*Leguminosae.*

21. Tamarindus Indica Linn.

The fruit of *Tamarind-Tinhiri* or *amli* ripens in late cold season. It is supposed to be an African tree and was introduced to India in remote times. The fruit filled with pulp is drunk as "sherbut" or cooked in curriesandchutneys and also used for pickling fish. The plant is common throughout the plains of India.

22. Arachis hypogaea Linn.

The *Monkey nut, Pea nut* commonly known in this country as *Chinibadam* or *bhuichana* is a recent introduction to India from its original home in Brazil. It may have come to India via China hence it is called Chini badam. It is grown all over India but on a commecial scale in Madras and Bombay Presidencies. The seeds are eaten fried or cooked and yield an oil of trade. There are several varieties of the plant.

Family—*Rosaceae*

23. Eriobotrya japonica Lind.

The *Loquat* or *japanese Medlar* is indigenous to the hills of the Central and Eastern China. It is cultivated commercially in Japan and China. It is grown successfully in the Eastern and Northern India like *Litchi.* The fruit ripens in middle of March and is much appreciated in India. Japan produces 20 million pounds annually and China exported 20,000 dollars' worth from a small village in Chiking one year. The better variety is worth cultivating in India in suitable places and on a larger scale.

24. Prunus communis Huds. vâr. insititia

The plant—the well known *alu bukharara* is widely cultivated in the western Himalaya from Kashmir to Garhwal in India at an elevation of 5,000 to 7,000 ft. It is supposed to be indigenous to the western Himalayas.

25. Prunus Amygdalus Baill.

The *almond*, known as *badam* or *belati badam*, is cultivated in Kashmir and Punjab, It is supposed to be indigenous in Western Asia. There are two varieties—one bitter and the other sweet.

26. Prunus persica Benth. & Hook.

The *peach* or *Nectarine* sometimes called *Shaftalu*, *aru*, *bem* and so on is indigenous to China but extensively cultivated in India especially on the North western and eastern Himalayan region up to an elevation of 1000 ft. The taste of the fruit varies according to elevation, soil and climate. The fruit ripens in May and October.

27. Prunus armeriaca Linn.

The *qpricot* sometimes called "Thorn of the faithful" supposed to have come to India originally from China, It is grown in the western Himalaya. The fruit ripens from May to September according to elevation. The fruits are eaten both fresh and cooked when dried.

28. Prunus Avicene Linn.

The *cherry* is the well-known fruit. The plant is cultivated in the N. W. Himalayas region for its sweet edible fruits. More than 600 varieties are under cultivation in the present times in different parts of the world particularly in the Mediterranean region.

29. Pyrus communis Linn.

The common *pear* or *Nashpati* is wild in Kashmir and cultivated in suitable areas all over the Western and Eastern Himalayas and the Nilgiris in South India. The fruit, as grown in India, is of inferior quality but those

cultivated in Kangra and lower ranges of the Himalayas from imported European stocks are quite good and exported to the hills and the plains all over India.

30. Pyrus Malus Linn.

The *apple (Sher, Seb)* grows almost wild in the western Himalaya from an altitude of 5000 ft. to 9000 ft. It is cultivated on a wide scale in the Himalayas, the Punjab, Sind, North West Provinces, Central India and the Deccan Peninsula. Kulu apples are quite famous and are exported and meet much of our internal consumption.

31. Frageria vesca Linn.

Several species of the genus *Straw berry* are cultivated for their edible fruits both in India and abroad. The fruit is an aggregate of achenes on a fleshy receptacle. It is cultivated in Sikkim and Kashmir and .westwards in Afghanistan. It can be grown in the plains too but the fruits are not good.

Family—*Myrtaceae*

32. Eugenia jambolana Lam,—(Syzygium jambolanum (Lam.) D.C.)

The *black-plum* or *Jam* better known as *Kalo-jam, jambu* or *jaman* is common throughout India and Burma. The tree is found among the evergreen members of the middle hill-forests upto an altitude of 6,000 ft. It is widely cultivated and there are several varieties the better ones are larger with smaller seeds and the pulp is sweet and has agreeable flavour. The fruits are also used for the manufacture of vinegar and they are of medicinal value.

33. Eugenia jambos- (Syzygium jambos (L) Alston)

The rose-apple or rose-jamn or better known locally in Bengal as Gulabjam is indigenous in the Eastern India but found wild in Eastern Bengal and Assam also extending upto Manipur, Naga Hills and Burma. The fruit ripens towards the end of the rains. It is not much juicy but has a delicate sweet flavour and the tree is often cultivated in the gardens.

34. Eugenia malaccensis Linn.—(Syzygium malaccensis (L) Merr. and Perr.)

The *Malay apple* or *jamrul* as it known in vernacular was introdued from the Malay to India. The plant is fairly widely cultivated in Bengal, South India and Burma for its sweet juicy turbinate fruits. There are several varieties. The best variety of this tree can be grown profitably to meet at least the internal consumption. The fruits ripen in early autumn.

35. Psidium Guyava Raddi.

The *guava* or as known in vernacular *Peyara, amrut* or *anjir* is indigenous in Mexico and other parts of Tropical America. The tree was evidently introduced by the Portuguese some time in the first decade of the 18th Century. The plant is cultivated in most of the warmer parts of India but the best varieties are grown in Allahabad and its neighbourhood and also in Benares and Saharanpur. The fruits ripen in the cold season and the pulp is suitable for the manufacture of jelly or the "Guava Cheese". Ripe fruits are also eaten fresh.

Family—*Lythraceae (Punicaceae)*

36. Puncia granatum Linn.

The *pomegranate, Dhalim* or *Anar* is grown in many parts of India and Burma but the fruits grown in the Western Himalayas at an elevation of 3-6000 ft and those grown in Afghanistan and Beluchistan are of very high quality. Those grown in Bengal are of poor quality and green fruits are susceptible to the attack of a caterpillar. The calyx lobes should, therefore, be removed in very young stage of the fruit and protected by a covering of lnen cloth.

Family—*Onagraceae*

37. Trapa bispinosa Roxb.

The *water chestnut,* commonly known as *Paniphal* or *Singhara* is a common water plant in lakes, jheels, tanks

and pools and is cultivated for its edible fruits. It is extensively cultivated in Kashmir, United Provinces, Bengal and some parts of Assam and Burma. There are several species and varieties. The fruit is eaten fresh or cooked. Kernel is dried and powdered and the flour is made into breads which are eaten by poorer people during famine.

Family---*Passifloraceae (Caricaceae).*

38. Carica Papaya Linn

The *papaw* or *papnya* yields the well-known fruits which is widely eaten by all. Several varieties have been produced since its cultivation from 1611 or thereabout when the plant might have been introduced to India by the Portuguese. The ripe fruits are innocent and wholesome and digestive. The young fruits are made into curries. The quality of the fruit varies with the nature of the soil and climate. In the Santhal Parganah and parts of Assam, Bengal and Mysore the fruit is of large size and the pulp delicate and very sweet. The fruit is used for medicinal purposes.

Family--*Cucurbitaceae*

39. Citrullus vulgaris Schred.

The *watermelon* or commonly known in Indian as *Tarbuz* is supposed to be African origin. The fruit ripens in the hot months. The Bengal fruits are smaller and not so tasteful. It is grown on a commercial scale in the United Provinces (Faizabad) and Western India (Sind) and the best varieties are very large, sometimes 20-30 lbs. in weight and the ripe fruit is delicious to eat.

40. Cucumis sativus Linn.

The *cucumber* is commonly known in this country as *Khira* or *Sasa* whose original home was North India. This plant has been under cultivation from ancient times. The large oblong fruit is eaten raw or cooked as curries.

41. Cucumis Melo Linn.

The *sweet-melon* or *Karbhuz* as it is called in vernacular is extensively cultivated in the North India and

Western India. There are several varieties but the *Sarda* of Kabul and *Safedah* of Lucknow are delicious. The best varieties are grown from imported seeds from countries westward of India. There is a good trade on this fruit.

Family--*Sapotaceae*

42. Achras sapota Linn.

The *Sapodilla* or *Sofeda* is indigenous to Tropical America (Mexico). The plant is grown along the western coast of India and Bengal and other parts of India. The fruit, some what like Mangosteen, is esteemed by many.

Family--*Ebenaceae*

43. Diospyros Kaki Linn

This is the *Japanese Persimon* or the *Chinese Date Plum* known as *Kaki* supposed to be of Chinese origin but many regard it as wild in the Khasia hills--where it might have emigrated. The rind is of rich ruddy colour and the Khasia variety is appreciated although it has a rather disagreeable odour. The fruit ripens in autumn.

Family—*Apocynaceae*

44. Carrissa carandus Linn.

The *Bengal currants* or known in vernacular as *karamcha* is cultivated for its acid fruits which are eaten raw or made into preserve or cooked as chutney. The plant is wild and is often planted as hedge in Bengal, United Provinces and South India, The fruit ripens in July and August.

Family--*Solanaceae*

45. Physalis peruviana Linn.

The *Rashbhari* or known in vernacular as *Tepari* is eaten by many. The plant is cultivated throughout India for its edible, juicy and ripe yellow berries of sub-acid taste.

Family--*Euphorbiaceae*

46. Phyllanthus emblica Linn.

The *Emblic Myrobalan, Amloki* as it is commonly called, is found nearly throughout India extending up to

4,000 ft in the dry deciduous hill-forests. The fruits are eaten fresh or made into preserves. The ripe fruits are used as astringent and laxative medicines. The pulp of the fruit is used in the manufacture of pottery.

Family-- *Urticaceae* (*Moraceae*)

47. Artocarpus integrifolia Linn,

Jack-fruit-known in vernacular-*Kanthal*, *Panasha* is indigenous to India. It has been cultivated in the east since ancient times. According to Alphonse De Candolle the tree is wild in the mountains of India. It was not cultivated on a wide scale before the Christian era. It is common in many parts of India particularly in lower Bengal, Ceylon and Malayan region. There are several varieties of this species and the fruit is the largest multiple or composite fruit known as *Sorosis*. The succulent wall of the ovary and the periath are delicious. The unripe fruit is eaten as vegetable. The ripe fruits are available in large number in April to June and occasionally a late variety is found in the market during the cold months. The fruit is borne on the trunk (cauliflowers) and also comes out of the roots and ripen underground.

48. Ficus elastica Linn.

This is the edible fig—commonly known in vernacular *Dumur*, *Angir* or *Kimri*. It is introduced to India from Europe and is cultivated in Baluchistan, Afghanistan and Kashmir. The plant bears fruit from the second or third year and continues fruiting up to fifteen years and fruits twice a year. A good variety but inferior to Baluchistan and Afghanistan is grown in the village of Khet Shivapur, South of Poona.

MONOCOTYLEDONES

Family.—**Scitamineae (Musaceae.).**

49. Musa sapientum Linn.

The *Banana—kala* or *kela* is extensively cultivated in Bengal, Assam, Manipur and Burma. There are many

varieties of Banana. The fruit varies in taste, size and colour according to the particular form or variety grown in different kinds of soil and climate.

Family.--**Bromeliaceae.**

50. Ananas sativas Linn.

The pine apple Ananas is a Brazilian plant which flowers in February and March and fruit ripens in August to October. In late autumn the fruits are fully developed. The plant was introduced into Bengal by the Portuguese in 1594. It is now widely cultivated in Bengal, Assam and the Western ghat. There are several varieties of fruits of different size and taste. The fruit is a composite fruit (Sorosis). Not much attempt has been made to improve the quality of the fruits by modern method.

Family. **Palmae.**

51. Borassus flabellifar Linn.

The drupacious nut of the Palmyra tree known in vernacular as *Tal* is edible both when green and ripe. In green stage *Talsans* eaten in April and May fresh both the fluid and the jelly like albumen. When the fruit ripens in July and August the succulent mesocarp is eaten either fresh or made into various preparations. The cotyledon is also edible. The juice of young flower is tapped and fermented into an intoxicating liquor—the toddy (Tari). Jaggery is also made from the juice. The palm is common throughout the plains of India, Burma and Ceylon.

52. Cocos nucifera Linn.

The *co-coanut palm Narikel* or *Naryal* is indigenous to the Indian and Pacific Islands but extensively cultivated in the coastal provinces of India and Burma. The yield of cocoanut fruit per tree and per acre and taste of endosperm either in liquid state in green nuts (dab) or when ripe depend on soil and climatic conditions. Like tal, the flowers of cocoanut are also tapped for the same purpose. The fibres of the fruits are used for various purposes.

53. Phoenix sylvestris Roxb.

The *date (sugar) palm* or *Khejur* as it is calld is wild in many parts of India. It is abundant in Bengal, Bihar and United Provinces. The ripe fruits are yellowish or reddish and are of inferior quality. They are produced in great abundance. The tree is profusely tapped. The edible date of commerce is *Phoenix dactylifer* Linn. which is cultivated in the Southern Punjab and Sind. Efforts are being made in North India to produce better type of fruits from acclimatised plants grown from imported seeds by hybridisation.

Fruit Preservation Industry

By

K. C. Chakravorty, B. A.

Fruits and Food

Man has been, as you all know, a fruit eater even before he was meat eater or vegetable eater. We know, that fruit was considered to give sustenance as good as any other eatables. But civilisation has meant a continued addition to this means of livelihood. From hunting to agriculture and to the present age of industrial production is a long way; food in general has become easier to secure now for us all and supply is plenty undoubtedly though the unbalanced social system may lead to show scarcity of food in some region or among certain sections of the people. Thus we know, accounts for poverty and starvation in our midst. A similar lack of balance is also noticed in our notions and arrangements regarding our food even when we get it. We waste the wealth that our civilisation has placed in our hands, and we then blame one another or finish by condemning the very civilisation. This fruit has ceased to be the main food of man, it has become the luxury of only a few, rich or intelligent to supplement their main dishes. The common man at least in our country, would consider fruits to be too great and even fashionable a luxury for him. There are some reasons for this strange notion. For example, firstly, we understand by the word 'fruit' only the more costly products that pour into our Bazars from the distant gardens of Peshwar or Pindi. They are splendid things indeed. But let us not forget that Nature's bounty is not confined to one region nor to a particular kind of her produce. We have enough fruits here near at home in our very poor soil. Some of them are quite good to

taste and equally *fruitful* for our sustenance. And though we may consider fruits to be only the rich man's desserts, we do taste our seasonal fruits and replenish our supplies of the eatables without any fuss. So we go on removing any deficiency that may remain in our dietry. For, and this is the second point, that we do not know that our ordinary dishes do not give us a balanced sustenance. Milk, meat and Vegetables are not enough as our knowledge of dietetics tell us. A 'Fruitless' dish as the modern researches in Science have warned us, will lead to difficiency in Vitamins and food properties and thus prove fruitless to combat certain diseases from which we are found to suffer. "Eat more fruits" has been therefore the cry of the Health advisers of the West and this has been the advice of most of the civilised Governments to their people. It is unfortunate that we have not learnt it, nor our Government have launched any such campaign in an extensive scale so far.

So, we must recognise that we do not make, the most of the fruits that we have in the country. No doubt because of our ignorance who have not introduced many valuable fruits that our soil would grow if we take care to do it, i. e. introduce the proper kind of the fruit and give it the proper nurture in the possible kind of soil. For, we have a vast country that presents almost unlimited variety of soil and equally various climatic conditions. Our horticultural possibilities are great and we have to exploit them in the matter of fruit cultivation. But let us confess that we do not make good the fruit that we produce even now. The seasonal crop floods our market, overflows and goes for nothing. Indeed even some valuable fruits at times are found during the peak of the season to fetch no profit for the owner and they are allowed therefore to rot on the trees or in the gardens.

Thus there is a terrible waste all round—waste of the horticultural possibilities of the country in growing new fruits, waste of the fruits that like a tide come and go

from the market, and finally waste of the fruits that are allowed to lie beyond the reach. And the waste begets want. We find what an economic loss it has meant to us in India, and to the prospective business men who do not knew in what business they can set their hands to. If we knew how to preserve our fruits, even those we produce, we could still prove ourselves wise if not self-sufficient in this respect. Waste not want not this may still be said of us as far as our fruit-eating goes.

It is not a fact therefore that we do not require help from horticultural research to instruct us to grow new fruits, more fruits, and better fruits. We do require that help in all the directions and we find what great improvements are being done in this direction by the various horticultural farms maintained by the Provincial Governments. Here the question of the necessity of fruit preservation naturally arises of course that presupposes fruit production, fruit cultivation and horticultural farming. So far us, as we see, the solgans should be : *Eat more fruits, waste no fruits, raise more fruits.*

Waste no Fruits

Not that we are speaking about a thing which is new or unknown. Fruit or any food for that matter, was not so plenty to men in former times as to leave the fruits to go waste. Preservation of food in fact was the greatest care of men in those days ; for, it was so uncertain to secure food for the next meal for our hunting or fruit gathering forefathers. This was real economy, perhaps the only law of economy known to them. Times changed, but the basic law of economy could not be ignored even when food became less difficult to get men economised and preserved their food. Fruits however like fish or meat could not be preserved so long as some other eatables. Such fruits were sought to be preserved by the simple chemical processes the people of old knew. These still continue and are quite the popular process of preservation of fruits for which the people acquire a

taste easily and from their infancy—such are our Achars, Chutnies, Araks, Amsattas etc, etc. But science has placed at our disposal more knowledge and better processes of preservation and all waste can now be eliminated, even the skins and refuges may be made to yield many useful bye-products and valuable Chemicals. To ignore these possibilities of scientific preservation of fruits is to waste the wealth at our hands and destroy our own economic and industrial potentiality. For a fair and big industry can be reared if we just avail ourselves of the fruits that we can not utilise immediately or even preserve them by our old and familiar processes. In fact even the indigenous process can be vastly improved with the help of modern knowledge and researches in the line of fruit preservation Of course the main line of preservation can only be successfully and adequately done in a modern Factory in modern industrial process and equipped with all the necessary modern machines. It would therefore not at all be wise to ignore the older and traditional method of fruit preservation, as that form of production is the cottage industry form. And Achars and Morabbas and Chutnies have a ready market in our country whereas the European condiments have still to fight their way among the Indian people. The Cottage process can be pursued in a modest way with small Capital and is likely to be more attractive. But even then, it requires all the help of modern researches in fruit preservation and accessory things to hold its own in the market economically and to answer the growing and changing taste of our people. With this caution it may be maintained that real fruit Preservation is bound to be more and more and industrial process which can be done only in modern industrial lines. Naturally we are interested in this Second Form of the production – the *Machinofacture* as more scientific and more economic. It is economic by the price criterion and more economic as preserving national fruit-wealth of ours, by that criterion of Preservation.

Fruit and Vegetable Preservation Indispensable for the Fruit Industry

For we do not know how our unscientific way of life and our ignorance make us waste our wealth even the annual and seasonal fruit wealth and thus indirectly discourage all fruit farming too. It is hardly necessary to emphasize that fruit preservation is absolutely indispensable to the economic development of fruit farming. No country can expect to develop its fruit industry on sound lines without developing fruit preservation side by side because in every garden there is bound to be a certain percentage of fruit varying from 10 to 20% or even more, which is not really worth selling in the fresh market but which is nevertheless quite suitable for the manufacture of various fruit bye-products. Fruit farming can be profitable and can maintain continued progress only if first class fresh fruit is placed on the market, whether local or foreign, and it inferior fruit is utilized for various bye-products in a manner which will bring a reasonable income to the grower. All over India a large quantity of inferior fruits at present goes to waste, whereas it can be utilised very profitably for various bye-products. At times fruit of even good quality does not fetch a reasonable price because of a temporary glust in the market. Tomatoes in certain months do not fetch even -/12/- per maund, but after two or three months they can not be had even at ten times that price. From the report of the Director of Agriculture, Assam we understand that even the Queen Pineapple, the best of its kind may be had at about Rs. 3/- per hundred and the orange at Rs. 15/- per three thousand at the season time. From the fruit statistics of Behar we find that over 50% of the fruit produced cannot be marketed in proper conditions. Custard apple grows almost wild in large quantities in in Hyderabad (Decan) but a large quantities of this goes to waste. The necessity, for developing this Industry is therefore obvious.

Products for which there is Immense Scope in India

The greatest scope in India lies in the manufacture of fruit Juice & Syrups. India is a tropical country and the need for cold drinks is felt for a greater part of the year. Even in the Punjab cold drinks are needed at least 8 months in the year and in many other provinces in India practically all the year round. If Statistics of the amount of aerated waters, like orangeade, Lemonade, Strawberry etc as well as various, kinds of *Sharbats* and beverages consumed were collected throughout India they would be found to amount several hundred crores of bottles annually. Most of such drinks contain artificial colour, flavour and Saccharine, none of which has any food value. If real fruit juices could be substituted in the place of these synthetic preparations, it should prove, on the one hand a boon to the health of the consumer and on the other hand great prosperiry to the fruit grower. It would also stop a great drain of money from India as most of the Synthetic products are imported. from abroad. There is not the slightest justification for importing orange or lemon squashes or other fruit juices from foreign countries when such an amount of fruit is available here for manufacrure at a portion of the cost at which the improted products are sold. It is of course gratifying to note that whereas some years ago hardly any squash or fruit juices were manufactured in India and they were all imported from abroad and the consumers used to pay high prices for these. But now a days a large quantity of these fruit squash and juices are being manufactured at considerably a low price and to the advantage of the consumers they are being available at even a half price than the imported ones. Other products for which there appears to be a great scope throughout India and for which adequate raw material is already available in India are canned products from fruits and vegetables like .Mangoes, Pineapples, Litchies, Plums, Peares, Tomatoes, Peas, Beans etc, etc., and tomato juice, tomato ketchup, Jams, Jellies

from various fruits, vinegar, pickles crystalised or candised fruits etc., etc.

A great deal of the fruit that goes to waste at present may be utilised in manufacturing vinegar. The cost of making vinegar from some of the fruits does not amount to even an anna per bottle (excluding the price of the bottle) whereas about a Rupee per bottle is charged for the imported product. Similarly the essential oil from lemons & oranges imported from abroad sells in India at Rs. 9/- to Rs. 14/- per pound, while the oil may be obtained here in India from the orange and lemon peals that are thrown away, at very insignificant cost. It is estimated that even by hand method the peals of 100 malta oranges can yield about Rs. 3/- worth of oil (Haider, Palestine).

We find from the statistics that there is a huge import of fruits and vegetables products into India. The amount of this as estimated in the year 1938 comes to about Rs. 13,470,110/- it comprises of Cashew nuts, Currant and Raisins, Date and other fruits, canned fruits and vegetables, Jams, Jellies, Pickles, Chutneys, Sauces and Vinegar.

It is argued by many people that the import figures are not very big for India and show that Indians on the whole are not very much in fond of preserved foods. This argument is persistently advanced by even intelligent people. It, however, is highly misleading when it is borne in mind that imported tinned products or bottles juices are sold at such high prices that they are even beyond the means of well-to-do and rich Indians. It can easily be seen that only a fraction of Indian population can afford to purchase these foreign made products at such prohibitive prices, and no doubt they have been considered a luxury so far. These products in their country of origin largely in England and America, are retailed at about one-fourth the above rates, as is well known to Indians who lived abroad. If locally prepared products could be made available in

India, even at the prices prevailing in England or America, the demand for them will rise immensely.

Then again the problem of fruit preservation has to be studied from the view point of the grower what is the grower to do with his surplus or unsaleable fruit of easily perishable nature, the season for which in some instances, does not last more than a week or two ? Should a grower of Tomatoes or Mangoes be content with a price of a rupee or two per maund or even less in the height of the season or should he give up their production altogether ?. The whole subject has to be studied from the national point of view and in the interest of both the consumer and the grower.

Present position of Fruit Preservation in Different Provinces

I think everybody will realize the necessity as well as the possibility of fruit Preservation industry in India. Naturally the question arises : Where do do we stand in this matter ? This can be hardly answered with any certainty. Dr. Burns, the Agricultural Commissioner to the Government of India has tried his best to furnish us with an answer in his useful collection of data for 1939 from all provinces and Indian States (I.C.A.R.) appendices 1-111 to the scheme--item No. 44 (iii). From my little knowledge I am afraid that our industrial and other establishments have not been very mindfull in supplying data to Dr. Burns. Still this gives us the only available summary of the position of the Industry in India. This there were, we find in 1939 altogether 41 firms manufacturing fruit products in India, Bengal accounted only for 3 (though there were few more who have not sent their names to be included in Dr. Burns data). But from our own knowledge we know there are some other ventures in this line in Bengal which are not mentioned. In this respect credit goes to the Bombay firms numbering 9. Punjab firms numbering 19 and Madras firms numbering 5.

The Bengal firms do the only work of canning of fruits according to Dr. Burns but we know that some of the Bengal firms do canning of fruits, vegetables and fish, and we also manufacture Jams, Jellies, Chutney and all sorts of Indian condiments in an extensive scale. It is gratifying to note that some of the factories in Bengal are so well equipped with modern machineries that they manufacture their own sanitary tin cans also.

Fruit Preservation in Bengal

The position of the Provinces of Bengal with regard to the question of fruit Preservation, fruit canning etc. is not altogether happy. It is partly known and need not be elaborated. Of course, the question, as is admitted by all is linked above all with the question of horticultural farming, Bengal in that respect has to suffer from some natural handicap—her climatic conditions and her soil. Many of the fruits preserved or canned would not be naturalised in our province unless Scientific research enables us to secure some variety suitable for our conditions and enables us at the same time to modify our conditions as far as possible for such varieties. The Bengal horticultural scheme at work at Krishnagar, financed by the Imperial Council of Agricultural Research since 1934 is making modest experiments with Mango, Litchi Citrus; Guava, Papaya, Pineapple, Banana etc. Probably it lacks funds and on the whole it requires more extensive and intensive efforts to answer the purpose of the Province.

It has to be remembered that Bengal enjoys a variety of climate and soil conditions from the alluvial to the peculiar soil of Rampal (Dacca) which produces a distinct and well prized variety of Bananas (Martaban), and peculiar high level soil of Dacca, Mymensingh, Jalpaiguri that produces Jack-fruits, to the Himalaya District of Darjeeling which gives probably best variety of Indian oranges as well as English fruits viz Peaches, Pears, Apples in abundance and the damp hilly-tracts of Surma Valley

(though in Assam by administrative division, the Valley is in most respects a part of Bengal) which have extensive cultivation of Oranges (Chhatak variety) and pineapple (Jal duv variety) Mango of the nothern gangetic districts of Maldah, Rajshahi and Murshidabad can show some varieties, which are not large enough in volume to compare with the Behar and Benares crop that sells at Calcutta but the Bengal varieties are sent down countries as far as Chittagong and Sylhet and a portion of the crop is still wasted.

Fruit Preservation, Canning, preparation of other fruit products, Jams, Jellies, Syrups, Pickles, vinegar etc. naturally in Bengal depend on the Bengal fruits. But the Behar and up country fruits and vegetables i. e. mango, litchi, peas, tomato etc. are equally available to the fruit industry centre in Calcutta.

The Indian people in general do not take to industrial fruit products, preserved or canned easily. The traditional cottage products Achars, Morabbas etc. supply home needs and are in favour with the people otherwise. The educated Indian and European sections, who are the real clients of our products for reasons which can be easily understood, would accept foreign fruits and foreign Company labels more readily. Thus our canned goods find real markets overseas only. There again Indian labels are at a discount.

Impediments to the Development of the Fruit Preservation Industry

Besides the question of general Indian backwardness, specially of Bengal, in industrial efforts (which is due to our lack of experience and Capital), we have pointed out the specific impediments that stand in the way particularly in developing fruit preservation industry in our country.

These can be summarised in the words of a Government Report of the I.C.A.B. as :—

(1) The ignorance about the potentialities of this industry is proverbial.

(2) Adequate research has not been done so far for the guidance of prospective fruit preserves in the preparation of products, nor is even ordinary information sufficiently available regarding the setting up of the machinary, its cost etc.

(3) There is a great scarcity of men properly trained in this subject.

(4) There is also a strong prejudice against Indian made products which must be overcome by standardization.

(5) Containers, both glass jars and tins of desired quality are not a available at reasonable prices in India. There are also other factors, such as the high cost of sugar used in the manufacture of products, as well as low import duty on foreign products which require attention.

I should add one more to these viz.

(6) The Government in the past, because of our lack of presentation or their lack of fund was not helpful. But the I. C A. R. as well as our Bengal Government are now very keen to develop the industry.

How to Improve the Fruit Preservation Industry

The question naturally arises as to how to improve the fruit Preservation Industry then ? The efforts in this direction must take to broad lines, supplementing each other : First—Official support and second—Non-official readiness (a) to build on the one hand on sound economic lines and (b) on the other—to avail of the latest knowledge of the researches in the subject. We think we can and we should overcome some, and most of the impediments referred to by the followidg means :--

1. By establishments of Provincial Fruit research stations. Though we do not deny the utility of a Central Research station in India we do hold that Regional stations, if maintained on a stable and efficient basis, would be of real service. The main purpose of such research stations would be :

(a) Standardisation of fruit products.

(b) Researcħ work.
(c) Improvement of commercial products.
(d) Advice and guidance to the prospective manufacturers in the selection of canning equipments, lay out of the factory and also advice about the manufacture of various products.
(e) The last and most important work of such institutions would be *teachiug* and *training* men for the industry.

Particular attention has to be drawn to the last items viz Training, lack of which accounts for the backwardness of the Indian industries. If the youths of our country are trained in this line we are certain that India will be in a position to produce fruit and vegetables products in large quantities and will make a great economic saving by barring out the foreign made products and also will solve a problem of unemployment question to a certain extent.

It would be needless to emphasise the necessity of having provincial fruit research stations. It can be said from experience that the local needs, local commodities, the structure of local market, require that competent advice should be locally available to our modest cottage manufacturers of Acharas, Amsatta (Dried Mango Juice) Morabbas (Preserves) pickles etc., etc. A provincial station alone can do it and help to raise the public taste and extent the scope of the productions.

2. Cold storage Facilities.

Cold storage can help us to preserve seasonal fruits for some days even before they are tinned and canned. The public get them fresh and the public would give preference to them naturally to the tinned articles. But it would be an ecomic proposition, judged by the fruit prices in our markets. Cold storage can do better service to preserve fish, meat etc., etc, than to vegetables and fruits. Cold storage can only keep such fruits for a limited period —say two or three weeks.

3. Canning and fruit preserving Research institute
4. Horticultural research and Experiment.
5. Pushing of the Indian fruit products in India
and outside with Govt. lelp.

Mach of these items of improvement are to be expected from the Government but our own taste to bring these into actual working. We consider to be no less, which may be summed up as follow :

(a) Putting the industry on sound and strictly scientific basis—which means to secure capital, secure trained men, secure new knowledge, secure regular accountancy supervision, secure good publicity by combined Indian pool, secure good salesmen i.e. marketing facilities.

(b) Extend internal market by creating tastes, explore the market overseas and exploit as well the native taste as it is with a view to raise that to appreciate the more improved products.

Such are our needs in brief, the needs in fact of both the cottage and factory indutry in the line. And, we hope we all realise that an opportunity awaits us here if we try to put our indusrry on a scientific basis.

Chief Patron :

His Excellency **Sir John Arthur Herbert,** G.C.I.E.

Governor of Bengal.

Patrons :

1. The Hon'ble Mr. A. K. Fazlul Huq—Chief Minister.
2. „ „ Nawab Khwaja Habibullah Bahadur of Dacca (Minister).
3. „ „ Dr. Shyama Prasad Mookerjee, Minister,
4. „ „ Mr. Sontosh Kumar Basu „
5. „ „ Mr. Pramathanath Banerjee „
6. „ „ Khan Bahadur Maulvi Hashem Ali Khan „
7. „ „ Khan Bahadur Maulvi Abdul Karim „
8. „ „ Mr. Shamsuddin Ahmed „
9. „ „ Mr. Upendranath Burman „
10. The Rt. Hon'ble Lord Sinha of Raipur.
11. Lt. Col. Sir Hassan Suhrawardy O.B.E., M.D., LL.D., D.Sc.
12. Most Reverand F. Westcott D.D. Lord Bishop of Calcutta and Metropolitan of India.
13. Mr. P. N. Brahma—Mayor of Calcutta.
14. Nawab Bahadur of Murshidabad, K.C.S.I., K.C.V.O.
15. H. H. The Maharaja of Sikkim.
16. H. H. The Maharaja of Cooch Behar.
17. H. H. The Maharaja of Tripura.
18. Maharaja Sir Pradyot Kumar Tagore Bahadur, K.C.I.E.
19. Maharajadhiraj U. C. Mahatab M.L.A. of Burdwan.
20. Sir Henry Birkmyre Bart.
21. Mr. B. N. Mookherjee—Sheriff of Calcutta.
22. The Hon'ble Mr. S. C. Mitra, M.L.C. President, Bengal Legislative Council.

23. The Hon'ble Sir Md. Azizul Haque Khan Bahadur C.I.E., M.L.A., Speaker, Bengal Legislative Assembly.
24. Sir P. C. Ray, C.I.E., D.Sc., PhD.
25. Mr. E. N. Blandy C.S.I., C.I.E., I.C.S., Chief Secretary to the Govt. of Bengal.
26. Mr. H. P. V. Townend, C.I.E., I.C.S. Commissioner, Presidency Division.
27. Khwaja Sir Nazimuddin K.C I.E., M.L.A.
28. Sir Bijoy Prasad Sinha Ray, M.L.A.
29. Maharaja Srish Chandra Nundy of Cossimbazar, M.L.A.
30. Mr. H. S Suhrawardy, M.L.A.. Bar-at-Law.
31. Nawab Mushroff Hussain, Khan Bahadur, M.L.A.
32. Mr. P. D. Raikut, M.L.A.
33. Mr. M. B. Mullick, M.L.A.
34. Mr. Tamizuddin Khan, M.L.A.
35. Sir Adamji Hajee Dawood.
36. Sir Abdul Halim Ghuznavi, M L.A. (Central).
37. Mr. G. B. Morton, O.B.E., M.C., President, Bengal Chamber of Commerce.
38. Dr. N. N. Law P.R.S., Ph.D. President, Bengal National Chamber of Commerce.
39. Mr. A. R. Siddiqui Bar-at-Law, M.L.A. President, Muslim Chamber of Commerce.
40. Rai Bahadur Sir Badridas Goenka C.I.E., President, Indian Chamber of Commerce.
41. Mr. M. R. Jaipuria—President, Marwari Chamber of Commerce.
42. Mr. B.M. Birla.
43. Mr. D. P. Khaitan, M.L.A.
44. Mr. G. L. Mehta.
45. Maharaja S. K. Acharyya Choudhury of Mymensingh.
46. Maulvi Haji Md. Amin.
47. Mr. K. L. Jatia.
48. Sir Henry Richardson.
49. Mr. Arthur Moore, Editor, "The Statesman".
50. Mr. T. S. Gladstone.
51. Khan Bahadur Sheikh Fazal Elahi, M.L.C.

52. Mr. T. Chapman Mortimer, M.L.A. (Central).
53. Mr. P. J. Griffiths, M.L.A. (Central).
54. Mr. J. B. Ross, M.L.C.
55. Sir William Lamond.
56. Mr. Neil Brodie.
57. Mr. R. Foster.
58. Raja Manilal Singha Ray Bahadur of Chakdighi.
59. Rai Bahadur Seth Sukhlal Karnani C.B.E., O.B.E.
60. Seth Sundarlal Daga M.L.A. (Central).
61. Nawabzada A. F. M. Abdul Ali, Khan Bahadur.
62. Sir Bernard Pratt.
63. Mr. John Bartos.
64. Mr. M. A. H. Ispahani M.B.E., M.L.A., Bar-at-Law Dy. Mayor, Cal. Corporation.
65. Mr. R. E. Marriott V. D. General Manager, E. I. Ry.
66. Mr. L. P. Misra, General Manager, E. B. Ry.
67. Mr. A. Duncan--General Manager, B. N. Ry.
68. Mr. Percy Brown, M.B.E., Curator, Victoria Memorial Hall.
69. Dr Rai-Sir U. N. Brahmachari Bahadur, M.A., M.D., Ph.D.
70. Mr. R. G. Baker.
71. Mr. B. N. Elias.
72. Khan Bahadur Alhadj S. Md. Jan M.L.C.
73. Mr. N. R. Das Gupta Bar-at-Law President, Improvement Trust Tribunal.
74. Mr. D. C. Ghosh, Bar-at-Law.
75. Sir H. H. Burn.
76. Khan Bahadur G. A. Dosani.
77 Sir S. S. Bhatnagar D.Sc., Director, Scientific and Industrial Research.
78. Khan Bahadur M. A. Momin C.I.E.
79. Mr. Valimohammad Kasam Dada.
80. Mr. Karamchand Thapar.
81. Mr. Abdur Rahim Oosman.
82. Mr. Adam Oosman
83. Sir Zahid Suhrawardy Kt.
84. Mr. A. Rahim C.I.E.

Office-Bearers

President

The Hon'ble Nawab Khwaja Habibullah Bahadur of Dacca.
Minister, Agriculture & Industries Department

Vice-Presidents

1. Mr. S. Basu, O.B.E., I.C.S., Secretary to the Govt. of Bengal, Agriculture & Industries Department.
2. Mr. M. Carbery—Director of Agriculture, Bengal.
3. Mr. S. C. Mitter -Director of Industries, Bengal.
4. Mr. Altaf Hussain—Director of Public Information, Bengal.
5. Dr. B. C. Mukherjee Director of Public Health, Bengal.
6. Mr. H. S. M. Ishaque, I.C.S.—Director of Rural Reconstruction.
7. Mr. M. A. H. Ispahani -Deputy Mayor, Calcutta Corporation.
8. Mr. S. Chatterjee -Chief Executive Officer, Calcutta Corporation.
9. Mr. Tushar Kanti Ghosh—Editor, Amrita Bazar Patrika.
10. Dr. K. P. Biswas—Superintendent, Royal Botanic Gardens.
11. Dr. J. B. Grant—Dirtctor, All India Institute of Hygiene and Public Health.

Honorary Secretary

Mr. A. R. Malik—Senior Marketing Officer, Bengal.

Honorary Assistant Secretaries

1. Mr. H. N. Ghosh, M.B.E.—Assistant Director of Public Information.
2. Mr. A. M. Ahmed—Superintendent of Agriculture, Western Circle.
3. Dr. S. N. Chatterjee—Public Health Department.
4. Mr. Md. T. Hussian—Assistant Marketing Officer, Bengal.
5. Mr. A. Haque—Officer-in-charge, Government Industrial Museum.

Members of various Committees :

1. Decoration Stall Committee

1. Mr. J. Niyogi—Officer-in-charge, Commercial Museum, (Convenor).
2. Mr. S. A. Haque—Officer-in-charge, Industrial Museum.
3. Mr. T. K. Sircar of Messrs Ideal Fruit Preserving Co.
4. Mr. H. L. Dasgupta of Messrs Suttons & Sons.
5. Mr. C. H. Mehta of Messrs Farm and Fruit Products Ltd.
6. Mr. A Roy of Messrs Globe Nursery Ltd.
7. Mr. E. A. Khan—Marketing Officer, Industries Department.
8. Mr. J. N. Mahalanobish – Assistant Marketing Officer, Bengal.

2. Judging Committee

1. Mr. Percy Lancaster—Secretary, Royal Agricultural and Horticultural Society (Convenor).
2. Dr. K. Biswas, M.Sc., Ph.D., Superintendent, Royal Botanic Garden, Sibpur.
3. Dr. S. N. Chatterjee of the Public Health Department.
4. Dr. B. Ahmed—Joint Secretary, Nutrition Committee.
5. Mr. U. R. Bhat—Marketing Officer, Govt. of India.
6. Mr. V. N. Vadhawakar—Horticultural Officer, Krishnagar.

3. Publicity Committee

1. Mr. H. N. Ghosh—Assistant Director of Public Information (Convenor).
2. Mr. B. Sengupta—Managing Director, United Press.
3. Ma. V. N. Boral of Messrs Boral & Sen.
4. Mr. J. Niyogi, Officer-in-charge, Commercial Museum.
5. Mr. K. K. Bhattacharjee—Assistant Marketing Officer, Bengal.
6. Mr. Q. M. Habib— do

4. Accounts Committee

1. Mr. D. K. Dutt of Messrs Sreekissen Dutt & Co. (Convenor).
2. Mr. A. M. Ahmed—Superintendent of Agriculture, Western Circle.
3. Mr. K. C. Chakravorty of Messrs Bengal Canning & Condiments Works Ltd.
4. Mr. C. H. Metha of Messrs Farm & Fruit Products Ltd.
5. Mr. J. Khan Chowdhury—Assistant Marketing Officer, Bengal.

5. Brochure Committee

1. Dr. G. Sankaran of All India Institute of Hygiene and Public Health (Convenor).
2. Mr. Percy Lancaster.
3. Mr. K. C. Chakravarty
4. Mr. J. Niyogi
5. Mr. H. N. Ghosh
6. Mr. K. K. Bhattacharjee—Assistant Marketing Officer, Bengal.

Honorary Treasurer

Mr. D. K. Dutt of Messrs Sreekissen Dutt & Co.

Honorary Auditor

Mr. A. M. Roy, M.A., B. Com (Edin), F.S.A.A., C.A.

Honorary Publicity Officer

Mr. K. K. Bhattacharjee, M.A., Assistant Marketing Officer, Bengal.

List of Donors

		Amount
1.	Mr. B. M. Birala	Rs. 200
2.	,, D. P. Khaitan M.L.A.	,, 100
3.	Sir Adamji Haji Dawood	,, 100
4.	Rai Bahadur Sir Badridas Goenka C.I.E	,, 100
5.	Mr. M. R Jaipuria	,, 100
6.	,, M. A. H. Ispahani M.L.A.	,, 100
7.	,, G. L Mehta	,, 50
8.	Maulvi Md. Amin	,, 50
9.	Khan Bahadur G. A. Dossani	,, 50
10.	Messrs. Bata Shoe Company	,, 25
11.	Mr. N. R. Das Gupta Bar-at-law	,, 25
		Total Rs. 900
12.	Mr. D. C. Ghose, Bar-at-law	

Besides the above, following Departments of the Govt. of Bengal have contributed towards the expenses of the Exhibition :

Marketing Department	Rs. 300
Agriculture Department	,, 200
Industries Department	,, 200

The Manufacturers of Fruit Products in Calcutta, have very kindly agreed to meet whatever may be required to cover the balance in excess of the above donations and contributions.

The help given by the Agricultural Marketing Advisor to the Govt. of India is also much appreciated in furnishing certain statistics and in deputing Mr. U. R. Bhat, marketing officer to help in judging the exhibits.

List of Exhibitors*

1. Messrs. Boral & Sen, 11, Holwell Lane, Calcutta.
2. „ Bengal Canning and Condiment Works Ltd.
   3, Gurudas Dutt's Garden Lane, Calcutta.
3. Mr. S. K. Basu, Krishnagar, Nadia.
4. Messrs. Daw Sen & Company,
   29, South Road, Entally, Calcutta.
5. „ Farm & Fruit Products Ltd.,
   24, Grant Lane, Calcutta.
6. „ Calcutta Cold Storage Ltd.,
   D1, Hide Road, Kidderpore, Calcutta.
7. „ Magnolia Dairy Products Ltd.,
   D2, Hide Road, Kidderpore, Calcutta.
8. „ Metal Box Company of India (Ltd),
   B2, Hide Road, Kidderpore, Calcutta.
9. Publicity Department, Corporation of Calcutta.
10. Marketing Department, Government of Bengal.
11. Messrs. Raja Ram & Co. 27, Grant Street, Calcutta.
12. Great Eastern Preserving Works 18, Blockman Street,
    Calcutta.
13. Messrs. Haji Tila Mohammed Bros.,
    S. S. Hogg Market, Calcutta.
14. The Fruits Merchants' Association, Calcutta.
    12, Ramlochan Mullick Street. Calcutta.
15. Sheikh Sukkur Mistry, Teretta Bazar, Calcutta.
16. Sheik Shakhawat Mistry, 165-166, Teretta Bazar, Cal.
17. Sheikh Anwar Mistry, 168, Teretta Bazar, Calcutta.
18. Government Agricultural Farm, Tejgaon, Dacca.
19. Messrs. S. A. Rahman & Sons, Grand Trank Road,
    Lahore, Punjab.
20. „ Pal's Fruit Products, Amritsar, Punjab.
21. „ Northern India Food Products, Lyallpur,
    Punjab.
22. „ A. Kalvert & Co, 123, Upper Duncan Road,
    Bombay 8.
23. „ Rural Products Co. Ltd, 754, Shukrawar,
    Poona 2, Bombay.

24. Messrs. Hindusthan Products Ltd., Moradabad, U. P.
25. „ L. R. Brothers, Shaharanpur, U. P.
26. „ G. G. Fruit Preserving Factory, Agra, U. P.
27. „ Lucknow Seed Stores, Morris Market, Kaisarbag, Lucknow.
28. Marketing Department, Hyderabad.
29. Mr. A. B. Mehta, Station Parsoda, N. S. Ry, via, Manmad.
30. The Agricultural Officer, Baluchistan.
31. Messrs. Gwalior Canning Industries, Kalapipal, C. I.
32. The Commissioner for Development and Agricultural Marketing, Ceylon Colombo.
33. Messrs. Sreekissen Dutt & Co. 33 2, Middle Road, Entally, Calcutta.
34. Ideal Fruit Preserving Co., 67, Badridas Temple Street, Calcutta.
35. Farmers Preserve Works 25, Robert Street, Calcutta.
36. Punnya Prosad Bordhan, Turnk, Sikkim, Testa Bridge Darjeeling.
37. Calcutta Fruit Trade Association 12, Ramlochan Mullick Street, Barabazar, Calcutta.

---

* It has not been possible to include the names of those Exhibitors who communicated their intention to participate in Exhibition after these materials were sent to the Press. The war emergency has interfered with the participation of a good number of potential Exhibitors, particularly, from other Povinces.

Directory of Manufacturers of Fruit and Vegetable Products in India & Ceylon.

BENGAL

1. Boral & Sen—11, Holwell Lane, Calcutta. Estd. 1923. Manufactures about 26000 dozen bottles of different products annually.
2. Daw Sen & Co—29, South Road, Entally, Calcutta. Estd—1897. Manufactures about 10,000 mds. of different products annually
3. Farm and Fruit Products Ltd—2A, Grant Lane, Calcutta. Estd—1919.
4. Basanta Kumar Agricultural Institute—Rajshahi, Bengal. Estd—1936.
5. Bengal Canning and Condiment Works Ltd—3 Guru das Dutta's Garden Lane, Calcutta.
6. Great Eastern Preserving Works—18, Blockman Street, Calcutta.
7. Dawn's Industrial Manufacturing Co—Raja Jatindra Nath Choudhury Street, Baranagar, 24, Parganas.
8. Sreekissen Dutt & Co—33/2, Middle Road, Entally, Calcutta. Estd—1841.
9. Farmer's Preserve Works—25, Robert Street Calcutta. Estd—1925.
10. Ideal Fruit Preserving Co—67, Badridas Temple Street Calcutta.
11. Mitter Sircar & Co—68, Serpentine Lane, Calcutta,
12. Jafar & Co—55, Hagg market, Calcutta.
13. Rezauddin & Bros—S.;S. Hogg market, Calcutta.
14. Atwool Dodd & Co—Dickson Lane, Calcutta.
15. Pickola Co—15, Clive Row, Calcutta.
16. Mida & Co—Konnagar, Hoogly.
17. Great Eastern Hotel Condiment Factory, Bibibagan Lane, Tangra, Calcutta.

MADRAS

1. New Era Manufacturing Co—Palghat, S.I. Estd—1933
2. India Fruits Ltd—Lakshminarayanapuram, Kadium P.o. Managing Agents, Moola & Anam Ltd.
3. Indian Canning Industries—Bezwada.
4. P. Venkatachalam—Indian Condiment Manufacturers. 1 & 2 Pophams Broadway. Madras.
5. Moonakshi Pickle Shop—Goodsshed Street, Madura.
6. N. K. Angappa Chettiar, Fort, Erode.
7. N. P. Palaniyappa Chettiar—Maligal Market Lane, Erode
8. K. A. Chidambaram Chettiar—Chonnimalai Rd. Erode.
9. L. Krishnaswami Chettiar and Angappa Chettiar—Chonnipalayam, Chonnimalai Post. Erade.
10. A. Ramaswami Chettiar—Chonnimalai Post, Erode.
11. The Malabar Fisheries Co—Chaliyom.
12. St. Antony Charitable Institute—Mangalore.
13. B. Arokiaswami—Mount Road, Coonoor R. S.
14. J. Gandart & Sons—Pondichery.
15. P. V. Madhava Rao & Bros.—Panyam, Kurnool Dt.
16. Sri P. Bangaru Raju—Moida P. O. Via Nellimaria, B.N.R
17. Kalyanpur Sugar Mills Ltd—Kalyanpur.

BOMBAY

1. Guzrat Alphonso Canners—P.O. Pardi Station, Dt. Surat. Estd—1939.
2. Pure Products Ltd—107, East Sion, Bombay 22 Estd—1939.
3. Satyabodh Canning Works—Kelshi, Dt. Ratnagiri Estd—1935.
4. Rural Products Co., Ltd—Reg. Office 923 A, Sadasiv Poona 2. Business Office 754, Shukrawar, Poona 2. Estd—1938
5. Central Canning Co—Karwar Dt. N. Kanara. Estd 1923. Approximate value of annual Production Rs. 7000

6. Premier Food Products Co. Ltd—Thalakuadi, Belgaum Estd—1934
7. Madhu Canning Co—Chichpokli, Bombay.
8. Has-ba Fruit Products—Poona.
9. Union Trading Co—Bombay.
10. Taj Fruit Products Co—Opp. Colaba Tram Terminus, Bombay
11. A. Kalvert & Co—Bombay.
12. Merwanjee Poonjajee & Sons—Bombay.
13. Muncherji, Manuckji, Poonjaji & Co—57-61, First Marine Street, Bombay.
14. Frumji Nowroji—9, Forbest Street, Bombay.
15. V. P. Bedekar & Co—Mughbat Lane, Girgaon Bombay
16. A. A. Kalawadwalla & Sons—123, Upper Duncan Road, Bombay
17. Desai Bros—Pawas, Dt, Ratnagiri
18. De Costa & Co—Goa
19. Seth Manekchand Kissendas, Utran, East, Khandesh,

PUNJAB

1. Indian Mildura Fruit Farms Ltd—P. O. Renala Khard, Dt. Montagomery. Estd 1933. Approximate quantity of products manufactured annully is about 8500 dozen bottles of squashes, canned fruits, marmalades and cooking essences and 20 tons of candied peel.
2. S. A. Rahman & Sons—G. T. Rd. Lahore, Estd 1905
3. Seth Abdul Hassain & Sons—Simla Jams Commercial Buildings. Lahore, Estd 1875
4. Indian Pure Food Products, Gojra—Dt, Lyallpur, Estd 1939. Manufactures 23000 bottles of different products & 3000 packets of dehydrated fruits annually.
5. Northern India Food Products—Gymkhana Road, Lyallpur, Estd 1941
6. Mohan & Co—Milkhi Ram St, Ry. Rd. Lahore
7. Punjab Agricultural College—Lyallpur
8. The Glacier Products (India)—Pathankot
9. Punjab Fruit Products Co—Model Town, Lahore

10. Farmer & Co—The Mall, Lahore
11. Govind Ram, Kahan Chand—Anarkali, Lahore
12. Punjab Pure Products Ltd—Lahore
13. United Finance Co Ltd—Rawalpindi
14. King & Co—Mozang Road, Lahore
15. Royal Fruit Products—Milki Ram St Ry. Rd, Lahor.
16. Bh Wadhawa Sing & Sons—Gumti Bazar, Lahore
17. Field Research Station—P.o. Ichhra, Lahore

DELHI

1. Harnrain Gopinath—Kharibaoli, Delhi
2. Nirula & Co—Connaught Circus, New Delhi
3. Beharilal Ghasi Ram—Kharibaoli, Delhi

UNITED PROVINCES

1. Hindusthan Products Ltd--Moradabad, Estd 1938. Approximate value of annual production Rs 50000
2. Agricultural Institute, Allahabad (Horticultural Deptt)Estd 1931. Annual production of different products about 1000 lbs
3. N. R. Dean Product & Co -Sadarbazar, Agra. Estd1941
4. Fruit Preservers Co-operative Society Ltd—Bharati Bhawan Street, Allahabad City Estd 1937
5. Narain Horticultural Gardens - Ajitmal, Etawh. Estd 1938
6. Canning Facrory The Commercial Lands & Forests Ltd. Shajahanpur
7. Girdhar Gopal Fruit Preserving Factory Belanganj, Agra
8. Allahabad Canning and Preserving Works Sukerganj, Allahabad
9. Bharat Canning Co Agra
10. Kanahya Lal & Sons Rawatpura, Agra
11. Daurala Sugar Works Daurala
12. Indian Canning Co Ltd Laxmikund, Benares.
13. Abdulla Jam Manufacturing Co Mussorie.
14. Habibulla Jam manufacturing Factory Dehra Dun.
15. Himalayan Jam Manufacturing Co. Mussorie.

16. Shamsuddin & Sons Mussorie.
17. Hukam Chand Raghu Nath Chowk, Benares City.
18. Arora Fruit Industry Charbagh, Lucknow.
19. Sharma Fruit & Vegetable Preserving Co.
Kasganj, Etawah.
20. Universal Fruit Preserving Factory Elgin Road,
Allahabad.
21. S. Wasiuddin—Sadderbazar, meerat.
22. Allen Orchard—Nainital.

BIHAR

Roland Canning Co—Yarpur Road, Patna. Estd 1941.

N. W. F. PROVINCE

1. Tarnab Govt. Farm, Agricultural Dept., Tarnab,
Peshwar.
2. Frontier Fruit Products Co., Peshwar.
3. Muhiyals Ltd. Peshwar.
4. Frontier Fruit & Allied Products Ltd.. Peshwar.

BALUCHISTAN

Govt. Fruit Experiment Station, Quetta.

BARODA

1. Fruit Preservation Laboratory Agricultural Experiment Station, Baroda Estd. 1937.
2. Madhav & Co., Baroda.

KASHMIR

1. Sapore Mission Farm, Sapore.
2. G. K. Madan & Sons.,
Srinagar & Jammu.

TRAVANCORE

1. Cape Canning & Cold Storage Co., Ltd.
Cantonment, Quilon.
2. West Coast Chemicals & Industries Ltd.,
Mudichal, Porbander.

CEYLON

1. The Commissioner for Development and Agricultural Marketing, Ceylon Colombo.

Statistical Tables.

A

(a) Area under Fruits and Vegetables (including root crops) in the British Indian Provinces.

Provinces	Acres.
Ajmer-Merwara	1,905
Assam	462,609
Bengal	815,600
Bihar	434,400
Bombay	202,617
C. P. and Berar	139,955
Coorg	9,900
Delhi	5,685
Madras	691,506
N. W. F. Province	36,741
Punjab	240,321
United Provinces	578,874
Orissa	150,222
Sind	45,726
Total	3,816,061

Area under Fruits and Vegetables (including root crops) in the Districts of Bengal (1940.)

District	Area in Acres
1. 24 Parganas	18,400
2. Nadia	23,200
3. Murshidabad	29,300
4. Jessore	3,700
5. Khulna	14,000
6. Burdwan	9,900
7. Birbhum	11,400
8. Bankura	14,600
9. Midnapore	10,300
10. Hooghly	12,100
11. Howrah	4,400
12. Rajshahi	27,700
13. Dinajpur	26,500
14. Jalpaiguri	19,400
15. Darjeeling	2,200
16. Rangpur	31,500
17. Bogra	16,500
18. Pabna	17,800
19. Malda	1,700
20. Dacca	114,800
21. Mymensingh	71,900
22. Faridpur	51,000
23. Bakarganj	180,500
24. Chittagong	5,900
25. Tipperah	8,400
26. Noakhali	87,100
27. Chittagong Hill Tracts	3,700
Total Bengal	223,400

B

Statement Showing estimated Production, Import Export & per Capita Consumption of Some Fruits in Bengal.

Sl. No.	Name of the Fruit	Estimated Production	Import	Export	Quantity available	Annual per Capita Consumption	Remark
1	Oranges	86,490 mds.	4,35,088 mds.	400 mds.	51578 mds.	6.6 ch.	
2	Limes	1,36,500 ,,	93,600 ,,	—	2,30,100 ,,	2.3 ,,	
3	Pomeloes	47,60,019 ,,	400 ,,	—	48019 ,,	6 ,,	
4	Mangoes	1734544836 ,,	49830500 ,,	3745600 ,,	1780629736 ,,	35.5 ,,	1936
5	Grapes	—	29,592 ,,	2,020 ,,	27,572 ,,	.4 ,,	1934
6	Cocoanut	48600000 ,,	982,500 ,,	8,000,000 ,,	41,158,500 ,,	.829 ,,	
7	Plantain	41207500 ,,	630 ,,	79,310 ,,	41208820 ,,	32 srs. 14 ,,	1935
8	Pineapple	233000 ,,	3700 ,,	—	236700 ,,	3 ,,	
9	Apples	625 ,,	33317 ,,	900 ,,	33042 ,,	.4 ,,	1935
10	Peas	2706 ,,	52680 ,,	815 ,,	54571 ,,	7 ,,	1935
11	Peaches	2150 ,,	1950 ,,	—	—		1935
12	Plums	3125 ,,	977 ,,	—	—		

C

IMPORT AND EXPORT.

(*a*) *Import of Fruits and Vegetables into India :*

1936-37	1937-38	1938-39
Value	Value	Value
Rs. 1,54,49,000	Rs. 1,58,23,000	Rs. 1,34,43,000

(*b*) *Export of Fruits and Vegetables from India :*

1936-37	1937-38	1938-39
Value	Value	Value
Rs. 1,97,13,000	Rs, 2,08,19,000	Rs. 2,26,86,000

(*c*) *Import of fresh Fruits into India :*

1936-37	1937-38	1938-39
Value	Value	Value
Rs. 8,48,989	Rs. 9,65,268	Rs. 10,69,905

(*d*) *Export of fresh Fruits from India :*

1936-37	1937-38	1938-39
Value	Value	Value
Rs. 2,06,135*	Rs. 9,31,265	Rs. 7,91,317

(*e*) *Import of fresh vegetables (including Potato) into India :*

1936-37	1937-38	1938-39
Value	Value	Value
Rs. 10,14,269	Rs. 39,07,105	Rs. 36.06,979

(*f*) *Export of fresh vegetables (including onions) from India.*

1936-37	1937-38	1938-39
Value	Value	Value
Rs. 30,86,280	Rs. 44,49,874	Rs. 40,43,338

(*g*) *Import of Fruits, nuts and vegetables into India from Afganisthan :*

1937-38	1938-39	1939-40
Value	Value	Value
Rs. 98,46,000	Rs. 1,06,28,000	Rs. 88.57,000

---

* Exclusive of Cocoanut figures for Madras.

(*h*) *Import of dried, salted or preserved fruits & vegetables into Indio**

1936-37		1937-38		1938-39	
Quantity Tons	Value Rs.	Quantity Tons	Value Rs.	Quantity Tons	Value Rs.
88,885	1,11,96,392	92,761	1,09,51,059	82,036	87,66,296

(*i*) *Export of dried, salted or preserved fruits and vegetables from India**

1936-37		1937-38		1938-39	
Quantity Tons	Value Rs.	Quantity Tons	Value Rs.	Quantity Tons	Value Rs.
18,339	1,36,88,963	22,924	1,48,38,846	31,137	1,61,12,190

* Exclusive of canned or bottled fruits and vegetables.

D

(*a*) *Import of fruits and vegetables (by sea route) into Bengal :*

1937-38	1938-39	1939-40
Value	Value	Value
Rs. 24,86,342	Rs. 25,52,271	Rs. 34,61,584

(*b*) *Export of fruits and vegetables (by sea route) from Bengal :*

1937-38	1938-39	1939-40
Value	Value	Value
Rs. 7,67,474	Rs. 11,40,744	Rs. 9,94,115

(*c*) *Import of fresh fruits (by sea route) into Bengal :*

1936-37	1937-38	1938-39
Value	Value	Value
Rs. 3,06,098	Rs. 3,43,456	Rs. 4,18,067

(*d*) *Export of Fresh Fruits (by sea route) from Bengal :*

1936-37	1937-38	1938-39
Value	Value	Value
Rs. —	Rs. 1,25,272	Rs. 1,71,558

(*e*) *Import of fresh vegetables (including Potato) (by sea route) into Bengal :*

1936-37	1937-38	1938-39
Value	Value	Value
Rs. —	Rs. 17,95,137	Rs. 18,42,794

(*f*) *Export of Fresh vegetables (including Onions) (by sea route) from Bengal :*

1936-37	1937-38	1938-39
Value	Value	Value
Rs. 6,750	Rs. 2,35,517	Rs. 1,53,387

(*g*) *Import (by sea route) of dried, salted or preserved Fruits and vegetables (not being canned or bottled) into Bengal* :

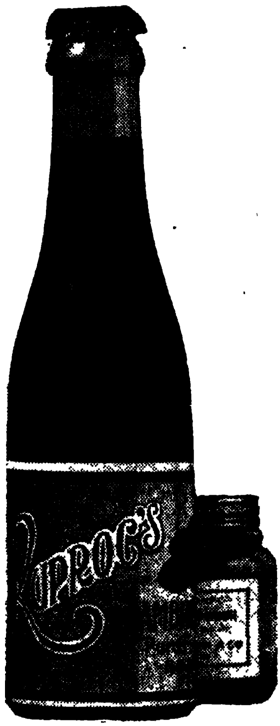
1936-37	1937-38	1938-39
Value	Value	Value
Rs. 2,55,982	Rs. 3,47,749	Rs. 2,91,410

(*h*) *Export (by sea route) of dried. salted or preserved fruits and vegetables (not being canned or bottled) from Bengal* :

1936-37	1937-38	1938-39
Value	Value	Value
Rs. 1,61,376	Rs. 4,06,685	Rs 8,15,808

(c) Statement showing the import of Potatoes in maunds into Bengal from other Provinces.

Sources	1937-38	1938-39	1939-40
Assam	235,296	21,515	185,193
United Provinces	651,136	659,022	542,406
Bihar	255,948	236,516	250,226
Madras	13,689	163,427	253,085
Burma	917,928	820,117	768,464
Total	2,073,997	1,900,597	1,999,374




Mixed Pickle
Onion Pickle
Piccalilli Pickle
INDIAN CONDIMENTS
DAW, SEN & Co.
CALCUTTA, INDIA
MANGOE SWEET SLICED CHUTNEY
GUAVA JELLY
DAWSEN'S
MADRAS CURRY POWDER